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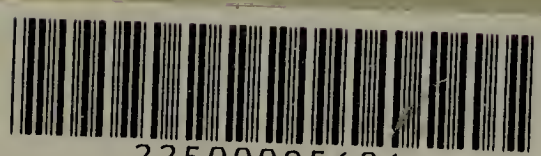
VOL. VI.

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STOMACH AND INTESTINES,  
SURGERY OF  
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GENERAL INDEX



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SAJOUS'S  
ANALYTICAL CYCLOPÆDIA  
OF  
PRACTICAL MEDICINE

BY

CHARLES E. de M. SAJOUS M.D.

AND

ONE HUNDRED ASSOCIATE EDITORS

ASSISTED BY

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Third Revised Edition

VOLUME VI



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## PREFACE.

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THIS volume is the last of the first series of the present work. That the promises enumerated in the first preface have been fulfilled can readily be ascertained by referring to the voluminous index given at the end of the present volume—a mass of literature probably never before brought together within the limits of six books. The work presents “all the general diseases usually described in text-books” and besides what progressive features the past decade has furnished. A number of subjects contain no excerpts from literature; in such instances the chief- and department- editors have found it more advantageous to incorporate the new ideas recently contributed by investigators within the text proper. In some, indeed, nothing but new facts could be introduced, so radically did the modern conception of the given subject differ from the older. On the other hand, some subjects could not be granted excerpt matter, because investigation had given them but little if any attention during the last decade, or because nothing new had been contributed.

Surgical subjects have been given space corresponding with their practical importance. The aim has not been to repeat what any physician already has several times upon his shelves—the classic procedures incorporated in books on minor surgery and repeated in the larger works, such as ligations, amputations, resections, etc.—but under each surgical disease, the special procedure indicated, besides the mere mention of the necessity of such an operation as amputation, resection, etc., is also furnished when such a special procedure has been devised. The subject of “Obstetrics” is replete with subdivisions which are but seldom if ever modified and which represent the foundation of every accoucheur’s education. All these have not been incorporated within the limits of the CYCLOPÆDIA. The various articles given bear upon the subdivisions which are undergoing progressive change and are intended to convey views that are in keeping with progress elsewhere. As regards “Therapeutics,” the subjects considered represent the remedies still more or less used, our text-books being replete with agents which may be said to be obsolete, from the fact that they have been replaced by others of far greater efficacy. The various specialties have received due attention, the aim being to furnish the general practitioner with a clear outline of the entire field of practical medicine.

The editor thought it necessary, when he projected the work, to eliminate individual symptomatic manifestations as special subjects and to only consider these under the diseases of which they form part. The first preface specifies

this feature of the general plan. By saving space elsewhere, however, he was able to introduce many subjects, such as deaf-mutism, eclampsia, menopause, etc., which usually receive but scant notice in text-books, and series of disorders such as hypnotism, hysteria, etc., which are seldom treated separately in such works. Indeed, it may truthfully be claimed that the *CYCLOPÆDIA* contains more than was promised, and that without imposing upon its reader additional expense.

The sixth volume contains a large number of valuable articles, most notable of which are "Diseases of the Stomach," by Prof. D. D. Stewart, of Philadelphia; "Surgery of the Stomach and Intestines," by Prof. W. W. Keen and Dr. M. B. Tinker, of Philadelphia; "Surgery of the Spine," by Prof. R. H. Sayre, of New York; "Syphilis," by Prof. G. F. Lydston, of Chicago; "Surgery of the Urinary System," by Prof. J. W. White and Dr. A. C. Wood, of Philadelphia; "Diseases of the Uterus," by Prof. H. T. Byford, of Chicago; and "Diseases of the Uterine Adnexa," by Prof. E. E. Montgomery, of Philadelphia; "Wounds and Injuries of the Chest," by Prof. L. A. Stimson and Dr. E. L. Keyes, Jr., of New York; and "Yellow Fever," by Surgeon-General Wyman, of Washington. To all these gentlemen, and the other members of the editorial staff, the editor wishes to extend expressions of sincere gratitude, since he owes mainly to their co-operation the great success which the *CYCLOPÆDIA* can claim as having attended its career.

Death has again claimed two of the *ANNUAL AND CYCLOPÆDIA*'s department editors, whose valued contributions have been greatly appreciated by our readers—Prof. Landon Carter Gray died on May 8th and Prof. Lewis A. Sayre on September 21, 1900. The special fields to which they devoted their efforts thus lost members who had become two of America's most brilliant representatives, and the profession at large two of its greatest educators.

THE EDITOR.

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# SAJOUS'S ANALYTICAL CYCLOPÆDIA OF PRACTICAL MEDICINE.

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## S

### STOMACH AND INTESTINES, SURGERY OF.

#### Surgery of the Stomach.

PRELIMINARY MEASURES. — When possible, it is specially desirable to clear the intestinal tract by a thorough purge, and, as preliminary to most operations, it is of great advantage to wash out the stomach. These measures are of unusual importance in gastric surgery; first, because they lessen the danger of contamination of the peritoneum by the escape of the gastric contents, and, secondly, because they lessen the likelihood of post-anæsthetic vomiting and retching. These, in some instances, if severe, may entirely defeat the end of the operation by causing the sutures to give way.

#### Surgical Treatment of Gastric Ulcer.

—Surgical treatment may be indicated in certain cases of non-perforating gastric ulcer; but immediate operation is always indicated in cases of perforating ulcer. Operation is always indicated in non-perforating ulcers which give rise to dangerous and repeated hæmorrhage and extremely severe pain and intractable vomiting and indigestion, provided all medical measures have been tried without avail. It is also indicated if there is any suspicion of malignant degeneration. In case of hæmorrhage, operation is indi-

cated only when the loss of blood has been excessive, whether from frequent small hæmorrhages or more than one severe hæmorrhage. After severe hæmorrhage excision of the ulcer and suturing by Lembert or Halsted sutures is probably the preferable operation, for erosion of a large blood-vessel is usually present. In less severe hæmorrhages gastro-enterostomy or pyloroplasty may be performed; these operations, by favoring emptying of the stomach, tend to put the ulcer at rest, and in some instances have been combined with excision, it has been thought, with advantage.

Twenty-one cases of simple ulcer of the stomach personally operated upon with but a single death. The indications for operation are recurrence of ulceration with marked deterioration of general health; resistance to medical treatment followed scrupulously for a long period; intense pain, especially when accompanied by obstinate vomiting; recurrent hæmatemesis; emaciation and cachexia; gastric dilatation; the formation of a palpable tumor, and the development of an extensive adhesive peritonitis. Gastro-enterostomy is preferred, and is applicable in all cases, no matter what may be the state of the lesion. Tricomi (*Revue de Chir.*, Feb. 10, '99).

Cases of gastric ulcer occurring at the Massachusetts General Hospital during the years 1888-98, inclusive, studied. In

187 cases hæmorrhage was present in 81 per cent., and caused death in 17 per cent. of the male patients, but only in 1.27 per cent. of the females. No woman under thirty years of age died of hæmorrhage. Perforation occurred in 3.2 per cent. of the cases, and all of these proved fatal. Of 114 patients, 80 per cent. were discharged cured or relieved, but at the end of an average of five years only 40 per cent. remained well. The mortality in these from gastric disease was 20 per cent. Among the males it was 30 per cent.; with the females, 9 per cent. The mortality of 8 per cent., and the failure of medical treatment to effect a lasting cure in 60 per cent. of the patients, indicate the need of surgical intervention in other than emergency cases of this disease. Greenough and Joslin (*Amer. Jour. Med. Sci.*, Aug., '99).

The writer's conclusions from a study of gastric ulcer in one of its simpler forms are that the purely medical treatment of all forms of this disease should be persisted in until hæmatemesis occurs, which is in 50 per cent. of all cases, or until progressive disturbances of nutrition result in emaciation and exhaustion, when it becomes strictly operative. (Perforative cases are, of course, always operative.)

Upon the occurrence of hæmorrhage, at any stage of the case and in any degree, the proper treatment is surgical and delay is useless, if not dangerous, as it cannot be ascertained how serious the condition is. There may be a threatened perforation or erosion of the wall of a large arterial twig, etc. It is this same uncertainty that hangs about appendiceal and gall-bladder disease that makes it safest to operate early. And not alone for this reason, but because the patient wants rest from suffering, which in the event of such a complication only seems the more hopelessly remote. Strobell (*International Journal of Surgery*, July, 1904).

#### PERFORATION IN GASTRIC ULCER.—

Perforation may perhaps be considered the most dangerous complication of gastric ulcer. Welch has placed the entire mortality from gastric ulcer at 15 per

cent., and he states that 6.6 per cent. of the cases die from perforation.

The diagnosis is usually not difficult. It is based, first, upon the history of the illness in which there have almost invariably been present the symptoms of gastric ulcer or of chronic gastric catarrh; and, secondly, upon the severe pain which is located in the left hypochondrium or epigastrium, and is often accompanied by vomiting and collapse. (See STOMACH, DISEASES OF.)

Perforation is met with more frequently in the anterior wall and more commonly near the cardia than the pylorus. In some cases perforation of both walls has been found. During the first sixteen years after Mikulicz performed the first operation 78 operations were reported, but in recent years the number of operations have rapidly increased until, in the year following May, 1898, 57 operations were reported. This is probably due to the fact that physicians recognize the condition earlier and promptly call surgical aid rather than that the number of cases of perforations has increased. As a rule, perforation occurs very suddenly without any apparent exciting cause, although violent exertion or traumatism have sometimes been the immediate cause.

Operative interference is called for in uncomplicated cases when medical treatment fails and the life of the patient is endangered, but the more important place for surgery is reserved in cases of cicatricial pyloric stenosis, with or without dilatation, in cases where hæmorrhages occurring frequently put the patient's life in danger, in cases where the symptoms are referred to perigastric adhesions, and, last, after perforation. In the last named the operation must be undertaken within twelve hours. The dangers of operations have to be measured in each case according to circumstances. W. Körte (*Deut. med. Wochen.*, Mar. 21, 1901).



Indications for surgical interference in gastric ulcer: 1. Acute hæmorrhages should rarely be treated by operation. When, however, hæmorrhage frequently repeats itself, even if severe in amount, it will demand operative treatment as soon as its recurrent character is plain. 2. Small, frequent hæmorrhages, threatening anæmia, clearly indicate operation. 3. Perforation of the stomach, either acute, with general peritonitis, or chronic, with surrounding adhesions and perigastritis, demands instant operation. 4. When an ulcer runs a chronic course with a strong tendency to recurrence, so that the patient's capacity for work and for the enjoyment of life is diminished, an operation is indicated. Cabot (Boston Med. and Surg. Jour., Aug. 29, 1901).

In cases of perforated gastric ulcer treated by operation the percentage of recoveries in the hands of those accustomed to operate is between forty-five and fifty. The sooner the operation is done the better will be the chances of recovery. Of Mayo Robson's 6 cases, 3 were operated upon within 24 hours and recovered; 3 after 24 hours and died. Of Ulster's list, 8 cases were operated upon within 12 hours, with 64 per cent. of recoveries; 6 after 12 hours, with 33 per cent. of recoveries. The disease is more common in men than is generally supposed. The writer reports 4 cases of his own, 2 of which were operated upon within 13 hours and 1 recovered. The other 2 were operated upon respectively 18 and 31 hours after perforation and both died. Maunsell (Brit. Med. Jour., March 23, 1901).

The main element in securing a favorable result in operations for perforated gastric ulcer is unquestionably an early diagnosis and a prompt resort to surgical treatment. The chief reliance should be placed on the location and severity of the pain, together with the board-like hardness of the abdominal muscles, in determining the diagnosis. Considerable help is afforded in most cases by the previous history of dyspeptic symptoms. Not much dependence can be placed on the absence or otherwise of liver dullness. Only once

in some half-dozen cases has the writer noticed so much tympanites as to obscure the normal percussion sound over that organ. Neither can much help be derived from observing the presence or absence of shock. Usually, more or less will be met with at the outset, but this is not always the case. Some vomiting commonly occurs, and at times a little blood is found in the vomited matter. A. B. Atherton (Annals of Surgery, Nov., 1904).

*Operation.*—As soon as the diagnosis is established with any degree of certainty, all food should be withheld and preparation should be made for immediate operation. When the diagnosis is considered absolutely certain, the incision is perhaps best made parallel to the border of the ribs, as most gastric ulcers perforate near the cardia and lesser curvature. In case of doubt, a median incision would be preferable. Careful search should then be made, first of the anterior wall of the stomach, beginning near the cardia, taking next the pylorus, and, finally, the posterior wall, the positions named being given in order of the relative frequency of perforation. The edges of the ulcer are inverted and one or two rows of Halsted or Lembert sutures are inserted. The excision of the ulcer is unnecessary in the great majority of cases. Special care should be taken that the entire ulcer is invaginated, and careful search should be made for a second perforation or dangerously thin area. Needless fatalities have resulted from the neglect of both of these precautions. If it is impossible to invaginate the edges of the ulcer, they may be drawn together by sutures as a cutaneous wound would be sutured, and in case of possible insecure suture, an omental graft may be sewed over as an additional safeguard. In case neither of these procedures is possible, because of the fixation of the stomach

by adhesions or great inflammatory thickening, the abdominal cavity should be walled off by iodoform gauze and a drainage-tube introduced down to the ulcer. The resulting fistula will usually close spontaneously, or, if necessary, it may be closed by a later plastic operation. After suturing the ulcer the most thorough cleansing of the peritoneal cavity is of the utmost importance; thorough flushing with large quantities of warm sterile salt solution should be carried out and any suspicious spots may be wiped clean with gauze. In order that all parts of the abdominal cavity be reached it may be necessary to separate peritoneal adhesions, and in some cases counter-openings may be made. Drainage is usually desirable, not only from the site of operation, but also from the pelvis.

In the after-treatment of the cases external heat, stimulating enemata, subcutaneous use of stimulants, and intravenous infusions of salt solution may be called for if severe shock is present. In order to give the stomach rest, nourishment is usually given by nutrient enemata for the first five or seven days. Capsulated collections of pus, which sometimes result from peritoneal infection, are best opened from an external incision, as the separation of adhesions may give rise to general infection. Success in this operation depends mainly upon early diagnosis and operation and thorough cleansing of the peritoneal cavity.

Patients operated upon within twelve hours from the time of perforation have excellent prospects for recovery, the mortality being about 16 per cent. in cases operated upon since 1896. Other factors of importance are the condition of the patient at the time of operation, the amount of food contained in the

stomach at the time of perforation, and the skill of the operator. The entire mortality in the cases thus far reported has been about 49 per cent.

Seventy-eight cases of operation for perforated gastric ulcer collected by personal assistant, Dr. Tinker, as compared with the 78 collected by Weir and Foote in 1896.

1. Age and sex: Of Keen and Tinker's 78 cases, 9 were men and 61 women; in 8 cases the sex was not recorded. All the men were over 25 years of age. Of the women, 41 were under 25 and only 16 over that age. The age was not stated in 4 cases.

2. The site of perforation was in the following situations in decreasing order of frequency: On the anterior wall, near the cardia, near the lesser curvature, near the pylorus, and on the posterior wall.

3. Ulcers not found: The number of cases in which the ulcer was not found at the time of operation has been very much less in recent cases than in those reported a few years ago. This has been partly due to the fact that more recent operators have had less hesitation in breaking down adhesions.

4. The mortality has been progressively reduced. Of Weir and Foote's cases, 55 died and 23 recovered, giving a mortality of 70.51 per cent. Of the cases collected by Keen and Tinker, 28 died and 50 recovered: a mortality of 35.89 per cent.

5. The mortality in relation to time of operation: An analysis of the 156 cases shows the following:—

TIME OF OPERATION AFTER PERFORATION.	TOTAL.	DIED.	RECOVERED.	PERCENTAGE OF MORTALITY.
Under 12 hours	49	14	35	28.57
12 to 24 hours...	33	21	12	63.63
24 to 48 hours...	27	21	6	77.77
Over 48 hours..	33	17	16	51.51
Not stated.....	14	10	4	
Total.....	156	83	73	53.20

If one wishes to have any reasonable prospect of recovery, the case must be operated on within the first twelve hours,



and practically the earlier the better. W. W. Keen (N. Y. Med. Jour., May 7 and 21, June 4 and 11, '98).

There is a very marked reduction in the death-rate since the introduction of operative procedures in 1880. Early series of cases gave a mortality of 71.51 per cent. as against 40 per cent. in the later cases. There is an immense difference in the mortality the earlier operation is done. Within twelve hours of the perforation the mortality was reduced to 19.23 per cent. The perforation was found in the anterior wall in 125 cases out of 240 collected; in the posterior wall in 32 cases; near the lesser curvature in 61; near the cardia in 74; near the pylorus in 40 cases. These figures of operative cases are in striking contrast to Welch's observations in the post-mortem room. Of 793 cases, 523 in nearly equal proportions were in the posterior wall and in the lesser curvature. C. E. Armstrong (Montreal Med. Jour., Aug., 1900).

**Gastrolysis.**—Gastrolysis—*i.e.*, freeing the stomach from adhesions—is an operation that has been found necessary in a considerable number of cases in which extensive adhesions have given rise to decided disturbances of digestion or to severe pain.

There are no positively distinctive symptoms of this condition, and consequently the diagnosis is very difficult. The cause of trouble has seldom been determined before operation. Strong, band-like adhesions may give rise to constriction or obstruction of the bowel.

By far the most common cause of such adhesions is gastric ulcer, but they may result from a peritonitis or from inflammatory conditions involving neighboring organs, such as the colon, pancreas, spleen, liver, gall-bladder, or abdominal wall. Another cause is injury, whether operative or accidental.

**Operation.**—Coeliotomy and division of the bands or breaking up the adhesions is usually followed by perfect re-

lief. As hæmorrhage sometimes results from the division of adhesions, it is best to cut band-like adhesions between ligatures when possible. The denuded surface left by the separation of adhesions should be covered with omentum if possible to prevent their forming again. In certain cases of very extensive adhesions, producing hour-glass contraction of the stomach or stenosis of the pylorus, gastropasty or resection may be necessary.

**Gastroplication, or Gastrorrhaphy.**—Gastroplication (this term being preferable) is an operation which consists in making a fold in the stomach-wall and suturing it, for the relief of chronic dilatation. If the dilatation is due to malignant pyloric stenosis, pylorotomy, gastro-enterostomy, or gastrectomy would be indicated instead of this operation. In dilatation resulting from non-malignant stenosis pyloroplasty would probably be the preferable operation. Gastroplication is thus mainly limited to the treatment of those cases in which stenosis is not present and in which the dilatation is excessive.

**Operation.**—After opening the abdomen the anterior wall of the stomach is folded on itself by lifting up the greater curvature to the lesser curvature, and it is held in this position by two or more rows of sutures. Certain operators prefer the use of purse-string sutures. Sufficient time has not elapsed to determine definitely the permanent results of this operation, but the unanimous verdict of those who have performed the operation is in its favor. Seventeen operations have thus far been reported, with only one death.

**Gastropexy.**—Gastropexy is the term used to designate the operation for fixing the stomach to the anterior abdominal wall by suture. The operation has

been performed for the relief of gastrop-tosis, or sagging of the stomach (Glénard's disease), which is with difficulty distinguished from dilatation. It has been successfully performed in three cases, but gastroplication or gastro-enterostomy seems to be preferred in the majority of cases.

**Gastro-gastrostomy, gastropasty, and gastro-anastomosis** are operations performed for the relief of hour-glass contraction of the stomach.

The most common cause of hour-glass contraction of the stomach is due to adhesions following gastric ulcer, but the condition may be congenital or may be developed in adult life without any known cause. A differential diagnosis between this condition and obstruction due to pyloric stenosis is, in many cases, almost impossible, for the symptoms of these conditions are practically identical. If severe disturbances of digestion arise, as is often the case, one of these operations would be indicated.

**GASTRO-GASTROSTOMY.**—In this procedure an opening is made in each of the two gastric pouches, and a free communication is established between them by the anastomosis of the opening. The operation is sometimes known as Wölfler's operation for hour-glass contraction of the stomach. It has been performed in five cases, with one death resulting. In gastropasty a longitudinal incision is made in the constricted portion between the pouches of hour-glass stomach; this incision is stretched at a right angle and sutured, as in the Heineke-Mikulicz operation of pyloroplasty. It has been successfully performed in seven cases. Watson, of Boston, has performed the operation of gastro-anastomosis in one case, by the following method: The pouches of the hour-glass stomach are folded on the

constricted portion as a hinge; the anterior wall of the stomach is incised to give access to the double septum between the pouches; an opening is cut in the double septum, which is then sutured, and the incision in the anterior stomach-wall is closed. In case of adhesions fixing either pouch, this method would, of course, be impossible. The three operations seem to be equally successful, and the one selected would depend entirely upon the conditions found in each case. Gastropasty would perhaps be the simplest operation if the constriction was not great. In case of a narrow constriction connecting the two pouches gastro-gastrostomy or gastro-anastomosis would probably be more applicable, though the latter would be impossible in case of adhesions.

In hour-glass stomach gastro-anastomosis as carried out by Wölfler is the most rational and the safest. It establishes a broad communication between the cardiac and pyloric ends, and at the same time lightens the task of expelling food from the already dilated cardiac portion by the deep location at which the anastomosis is established. For the last reason especially it is to be preferred to resection and pyloroplasty, with the establishment of the anastomosis nearer the small curvature. J. Hochenegg (Wiener klin. Woch., May 26, '98).

**Gastrotomy.**—The term "gastrotomy" has sometimes been used to designate an incision into the abdomen, but ordinarily it is used to mean an incision for opening the stomach.

The operation is performed for the removal of foreign bodies from the stomach; for the relief of stricture of the œsophagus; for exploration in case of doubt as to pathological conditions within the stomach; and as a preliminary to certain operations,—for instance, Loreta's method of divulsion for stricture of the pylorus or in per-



forming gastro-anastomosis by Watson's method.

Exploratory gastrotomy has been performed in a considerable number of cases in order to determine the diagnosis of pathological conditions, such as hæmorrhage arising from erosion of the arteries or small ulcers, incipient carcinoma, polypi of the mucous membrane, and other obscure conditions in which no positive diagnosis could be reached by other means. In most cases the diseased condition has been found and successfully treated and recovery has thus far followed in every case. The slight danger from the operation and the certainty which it gives as to the cause of trouble makes the operation thoroughly justifiable.

Instead of proceeding for months in treatment by medication of obscure gastric troubles an exploratory operation should be undertaken. In this way carcinoma of the stomach could be discovered sufficiently early in many cases to allow of removal, which would probably result in permanent cure. This procedure has been recommended by Kocher and Keen. Certain cases of apparently purely functional disturbances have, in some way, been relieved by exploratory operation. Ernest Maylard (*Lancet*, Apr. 8, '99).

*Gastrotomy for the removal of foreign bodies* is indicated when there is severe or continued pain or discomfort present, whether accompanied with nausea, vomiting, and hæmorrhage or not. It is also indicated for the removal of such foreign bodies as cannot pass through the intestinal tract or can only pass with great risk. Sharp or jagged bodies, such as bits of glass, pins, knife-blades, etc., have often been well tolerated by the stomach. Concretions of smaller bodies—such as fish-bones, cherry-stones, date-stones, pebbles, and masses of hair—sometimes give symptoms requiring their

removal. As a rule, any concrete substance the size of which allows it to pass the cardia will pass the pylorus without difficulty; but this is not true of long bodies.

Gastrotomy, simple incision followed by immediate closure of the stomach, is done first and principally for the purpose of removing foreign bodies from the gastric cavity. These may have been swallowed or been found in the stomach. The operation is indicated: 1. If the swallowed body is not smooth, but irregular, with sharp edges which may injure the tissues. 2. If it is too large to pass through the pylorus and at the same time gives rise to disturbances: pains, nausea, vomiting, etc. 3. In rare instances in order to examine the interior of the stomach with reference to the presence of malignant superficial neoplasms, ulcers, or ruptured blood-vessels in the case of profuse hæmorrhage. Max Einhorn (*Med. News*, Nov. 25, '99).

Very frequently the foreign body may be felt through the abdominal wall, and the history of the case generally leaves little doubt as to the diagnosis. If there is any question as to the cause of the condition in the case of children, insane persons, etc., the use of the x-rays will often clear up the doubt.

*Gastrotomy for the relief of stricture of the œsophagus* may be necessary in cases in which it is impossible or undesirable to dilate by means of a bougie passed by the mouth. If the œsophagus is dilated or pouched above the stricture, or if the stricture is situated low down near the stomach, dilatation is often practically impossible except after gastrotomy. A close constriction may be divided by Lange's specially constructed knife-blades or by Abbe's bowstring method; in other cases in which the stenosis is less marked, immediate dilatation by bougies or the fingers may be practiced. In such cases it is sometimes possible to close the stomach immediately. If the

stricture is more extensive, however, repeated dilatation is generally required, and a temporary gastric fistula may be established. This will either close spontaneously or may be closed by a subsequent operation.

*Operations.—Abbe's Bowstring Method.*—A firm cord is passed into the œsophagus through the mouth or—perhaps better—through an opening into the œsophagus in the neck; it is carried through the œsophagus into the stomach and out through the gastric incision. A bougie is then introduced to the site of stenosis, making the stricture tense, and the string, when sawed back and forth, divides only the tense stricture, and not the relaxed portion of the œsophagus.

*Loreta's operation* for stenosis of the pylorus consists in dilatation, either by means of instruments or by the fingers after preliminary gastrotomy. The mortality by this method of operation has been considerably greater than after pyloroplasty, and for this reason, as well as from the fact that the pylorus often retracts, the operation has fallen into disfavor.

*General Operation.*—The introduction of 8 or 12 ounces of sterile milk or water into the stomach before operating may prove of aid in locating the organ accurately. Some surgeons have suggested distension of the stomach by large quantities of gas, but in case ulceration is present, or if the stomach-wall is nearly perforated by a foreign body, or if it is friable from disease, this procedure is not without danger of rupture and subsequent infection of the peritoneum.

The incision may be made parallel to the lower border of the left ribs, or, in case of Loreta's operation or in operation for the removal of a large foreign body, in the median line. Before opening it the stomach should be brought out of

the abdominal cavity if possible and carefully examined to make certain that the stomach, and not the transverse colon, is being dealt with. The colon is recognized by its longitudinal muscular bands, its sacculation and the presence of the epiploicæ. Iodoform gauze should be packed about to avoid danger of contamination of the peritoneum, and a continuous circular fixation suture is of advantage for the same reason, as well as that it holds the organ firmly during the operation. The line of incision in the stomach-wall is perhaps best made parallel to the course of the blood-vessels,—that is, transversely to the curvatures; but much will depend upon the object of the operation. After this is accomplished the opening is closed by Lembert's or Halsted's mattress-sutures and the abdominal wound is closed without drainage.

**Gastrostomy.**—Gastrostomy is the operation by means of which a permanent fistula is established through the abdominal and gastric walls for the purpose of introducing food.

The operation is indicated to prevent death from starvation in case obstruction exists in the digestive tract above the stomach which prevents the introduction of food. Such obstructions arise from congenital closure, syphilitic stricture, diverticulum, or cicatricial contraction of the œsophagus, which may be caused by destruction of its walls from caustic chemicals, traumatism, scalding water, or eruptive fevers, such as typhoid fever. The obstruction may also result from the pressure of growths outside the œsophagus, but benign growths of the thorax, neck, or of the walls of the œsophagus are comparatively rare. Aneurisms of the aorta or the innominate artery or tumors of the larynx are also possible causes of obstruction.



Probably the most common source of obstruction is cicatricial contraction and malignant disease of the œsophagus or cardia. Epithelioma is the most frequent variety of malignant growth found in this locality.

As already stated under *ŒSOPHAGUS* (volume v), the objective signs are obtained by passing the œsophageal bougie and by auscultation. Sufficient emphasis can hardly be made upon the fact that the bougie should be soft and flexible, and should be passed with great care, as deaths have been reported from rupture of aneurisms, perforation of the pleura and of the œsophagus itself, even by skilled surgeons. Considerable familiarity with the sounds of deglutition in normal and diseased conditions is necessary in order that auscultation may prove of any decided help as a means of diagnosis.

*Operation.*—In the earlier operations the stomach was simply fixed to the abdominal wall by means of sutures, and was opened directly; but considerable difficulty arose because of the escape of the gastric contents, and the consequent excoriation of the skin. Various methods have been devised of late to obviate this difficulty. Whatever method of operation is adopted, the stomach should not be fixed too near the pylorus, otherwise the escape of gastric contents into the intestine is hindered.

*The Ssabanajew-Frank operation* was devised independently by those two surgeons, the technique of both being similar. It is generally preferred for the reason that by it the escape of gastric contents is avoided, as well as the necessity for wearing a tube. In this method an incision is made along the left costal border, and the stomach is seized and drawn out into a cone until the lesser curvature appears. The base of the

cone is firmly sutured in the incision by deep fixation stitches, and a second incision two to three centimetres long is made about two or three centimetres above the costal border; the skin between the incisions is undermined, the apex of the cone of stomach is passed under this bridge of skin, drawn out of the second incision, and fastened by sutures. The obliquity of the canal and the pressure of the strip of skin prevent leakage, and a tube is inserted only when food is given. The abdominal incision is closed immediately, and the apex of the cone of stomach is opened. It is very essential that the sutures hold absolutely tight, in order to prevent infection of the peritoneum and to prevent accumulation of secretion and the formation of a superficial abscess.

*Witzel's method* may be used in case the stomach is so firmly contracted that it is impossible to draw out a sufficiently long cone to pass under the bridge of skin. According to this method, after opening the abdomen and walling off the field of operation with gauze, a small drainage-tube is laid in a vertical direction on the anterior surface of the stomach near the cardia, and the stomach-wall is sewed together from both sides over it, the sutures passing through the serosa and one of the muscular layers. After one and one-half to two centimetres of the tube have been buried in this way a small opening is made through the stomach-wall at the lower end of the tube and the tube is pushed into the stomach a distance of six to eight centimetres. The stomach is securely sutured about three centimetres beyond the distal end of the tube, and the parietal incision is then closed about the tube. The external end of the tube is then kept closed by a clamp, except at the time of feeding. The mortality from

the operation is about 25 per cent. in malignant cases. There can be no doubt that it would be much reduced if the operation were generally undertaken earlier, before the patients were much weakened by the disease.

*Feeding by Gastric Fistula.*—The food should, at first, be given in small quantities and should be of such a nature as to be readily absorbed. Peptonized milk or pounded beef may be administered alternately with starchy and fatty food. Half a pint of food given slowly every four hours is a fair average as to quantity and frequency. After feeding by the fistula for some time it may be possible to somewhat increase the quantity and the interval, as too-frequent feeding irritates the stomach and the fistula.

**Pyloroplasty.**—Pyloroplasty is the term applied to the enlargement of a stenosed pylorus by plastic operation.

It is the operation of choice in simple non-malignant stenosis of the pylorus unless there is excessive fibroid thickening, recontraction of the pylorus, or possibly in case of excessive dilatation, when gastro-enterostomy is the preferable operation.

*The Heineke-Mikulicz operation* was devised and performed independently by the surgeons whose names it bears in 1886-87. According to their method, an incision is made in the long axis of the pylorus at the seat of constriction; the incision is then stretched at its middle at a right angle so as to dilate the strictured pyloric opening, and the margin of the incision is sutured in this new position, the edges being inverted so as to bring the serous surfaces in apposition. The advantages over gastro-enterostomy are its lower mortality, the absence of reflux of bile and pancreatic fluid into the stomach, and ultimately, in many cases, the restoration of normal

pyloric action and normal gastric secretion. The mortality varies with different operators from 7 to 21 per cent.

*Gastro-enterostomy.*—Gastro-enterostomy is the operation of establishing a permanent fistula between the stomach and some part of the small intestine.

Its main object is to aid in quickly and easily emptying the stomach of its contents. The operation may be absolutely necessary to prolong life in certain cases of obstruction of the pylorus, and it often proves of great benefit in such conditions as gastric ulcer and obstinate disturbance of digestion. In malignant diseases of the pylorus pyloroplasty is the operation of choice if the disease has not progressed too far, otherwise gastro-enterostomy is indicated. In the non-malignant forms of pyloric obstruction this operation is to be preferred, if the stenosis is extreme, the thickening very great, or in case of recurrent stenosis; in other non-malignant cases pyloroplasty is the operation of choice. It has been performed with encouraging success, especially by the French surgeons, in the treatment of obstinate digestive disturbances, particularly those associated with gastric ulcer.

Early surgical intervention is advocated in cases of cancer of the stomach. There are twenty instances on record of patients who have survived without recurrence the removal of gastric tumors proved to be malignant after intervals varying from four to eight years. Landouzy (Bull. de l'Acad. de Méd., No. 10, '99).

When the indications are similar to those for gastrostomy—difficulty in the onward passage of food, vomiting, progressive emaciation, and subnormal temperature—gastro-enterostomy may not be delayed without serious risk. Even if life is not prolonged by the operation the discomfort of the patient is much lessened. There is sometimes a great gain in weight. The tumor sometimes



entirely disappears after the operation. A posterior gastro-jejunostomy as close to the duodenum as convenient is preferred, or, in the complicated cases, an anterior operation. The method is determined by what is found on opening the abdomen, and by the extent to which the stomach remains mobile. Whether the food-current is isoperistaltic does not make much difference. Caird (Medical Press, May 28, 1902).

The operation is almost an ideal one. In simple ulcer it is chiefly indicated for repeated hæmorrhages. The author has performed the operation thirty-one times, with a mortality of two cases—6.45 per cent. With one exception, in all the cases pain and distention have entirely disappeared. Every patient operated upon for hæmatemesis was cured. In every case the pre-existent constipation disappeared, and the action of the bowels became normal. Waterhouse (Brit. Med. Jour., July 16, 1904).

*Operation.* — A median incision between the ensiform cartilage and umbilicus is generally preferred. In order that digestion and absorption be not interfered with, it is important that the upper part of the jejunum be selected for anastomosis. The beginning of the jejunum is the only fixed part of the small intestine, and it can usually be found without much difficulty just below the pancreas, to the left side of the vertebral column, near the root of the mesentery. A freely-movable loop of bowel should be selected, and the upper end of the bowel should be turned toward the cardia, so that the peristaltic waves of the stomach and bowel shall be in the same direction. The anastomosis of the intestine with the anterior wall of the stomach is the easiest method of performing the operation, but in most cases, and especially if severe digestive disturbances are present, posterior gastro-enterostomy, or suturing the intestine to the posterior wall of the stomach

after passing it through an opening in the gastro-colic omentum, is the preferable operation. In any case it is desirable to make the anastomosis at the most dependent part of the stomach near the greater curvature, to favor emptying the organ. Union may be effected by direct suture or by means of some of the numerous buttons, plates, rings, bobbins, or anastomotic forceps that have been devised for this purpose.

Of the various mechanical contrivances, Murphy's button has been most generally used. Continuous purse-string sutures are placed around the margins of the incision and the openings are drawn closely around the halves of the button; the halves are then joined and locked, and the operation is complete. If the condition of the stomach and intestine and the general condition of the patient permit, union by suture is perhaps safer, and the Laplace anastomotic forceps or those of Downes are aids of great value. Whatever method of union is chosen, the intestine is first squeezed empty and clamped on both sides of the proposed incision, leaving a clear space of 10 or 12 centimetres. An incision may be made in the long axis of the gut, or, as Kocher recommends, transversely to the axis of the gut through one-half its circumference on the free border. A fold of gastric wall is pinched up near the greater curvature and an incision of the same length as that in the intestine is made. The jejunum is then sutured to the stomach in a position perpendicular to the greater curvature, thus favoring free escape of gastric contents. If the method by suturing is adopted, the ends of the two incisions are united by separate single sutures and the lower or posterior lips of the incisions are united by continuous suture which perforates all the coats; the anterior or upper lips

are sutured in the same manner, except that, to facilitate their insertion, the stitch-loops are left loose and not tied until all have been inserted. The edges are carefully inverted as the sutures are tightened, so as to bring the serous surfaces into apposition, and a second row of Lembert or Halsted sutures are usually placed to reinforce the first, passing through the serous, muscular, and submucous coats. The mortality of gastro-enterostomy is about 35 per cent. for malignant cases operated upon during the past few years; in non-malignant cases it is much less.

**Pylorectomy.**—This term is generally used to designate the operation of resection, not only of the pylorus, but of as much of the duodenum and of the stomach as is diseased.

Almost the only indication for the performance of this operation is carcinoma of the pylorus, although it has been practiced in a number of cases for ulcer and cicatricial contraction. The encouraging results following this operation in the hands of skillful and experienced operators during the past few years seem to indicate that it is the coming operation for the treatment of carcinoma ventriculi. Physicians who are in doubt as to the possible existence of carcinoma should consult with a surgeon early, for, in the present state of medical knowledge, it is impossible to determine absolutely the existence of carcinoma in its incipency. An exploratory operation is of slight danger, and if the disease exists, and the operation is to be more than palliative, it must be undertaken early. Considering the harmlessness and simplicity of exploratory celiotomy, and the fatal consequences of delay, it seems not only justifiable, but urgent, that, if obstinate gastric disturbances do not yield to medical means,

operation should be undertaken, even in the absence of a palpable tumor. Factors of aid in the diagnosis are the existence of cachexia, age past 40, the absence of free hydrochloric acid, the presence of the Oppler bacillus, excess of lactic acid, hæmatemesis, and diminished amount of hæmoglobin and number of red blood-corpuscles.

*Operation.*—Considering the severity of the operation, preparation should be made for maintaining the body-heat of the patient, for free stimulation, and the intravenous injection of salt solution. A median incision between the ensiform cartilage and the umbilicus is usually made, and the field of operation is walled off with iodoform gauze to avoid infection of the peritoneum. Various methods of operation have been employed. Billroth resected the tumor, and, as the opening in the stomach is so much larger than that in the duodenum, the stomach wound was partially closed by suture until an opening was left of sufficient size for an end-to-end anastomosis with the duodenum. In order to facilitate the escape of gastric contents, the point selected for anastomosis should be below the upper or middle of the gastric opening, depending upon the amount of growth resected. Kocher first clamps both the stomach and the duodenum, resects the growth, and closes the wound in the stomach first by continuous deep sutures, then covers these by continuous Lembert suture; he then makes a posterior end-to-side anastomosis by inserting the duodenum into the opening in the posterior wall of the stomach. When the duodenum is not freely movable enough to allow it to be drawn up for the insertion of circular sutures, he prefers to use the Murphy button; in other cases he uses sutures. Czerny first performs posterior gastro-enterostomy



with Murphy's button and then, after resection of the tumor, he closes the stomach and duodenum. The Laplace or Downes forceps may be used in any of these procedures with advantage. The mortality of the operation has always been great,—in cases complicated by extensive adhesions about 72 per cent.; but a considerable number of cases have been reported in which patients have survived the operation two or five years, and one of Kocher's patients is living and in good health nine years after the operation. In the practice of skillful operators the mortality is believed to be 39 or 49 per cent., while several individual operators have attained over 75 per cent. of successes.

Rydygier's claim of having originated the method commonly called Billroth's method of performing circular pylorectomy not sustained. The first operation of this kind was done by Péan, in 1879; the second by Rydygier, in 1880. Both patients died. Billroth performed the first successful circular pylorectomy in 1881, and described the procedure. Both Merrem and Gussenbauer had made experiments upon animals at this time. No doubt remains that the first method of resecting the pylorus was Péan's and the second Billroth's. Alfred Stieda (*Deutsche Archiv f. Chir.*, May, 1901).

**Gastrectomy.**—By the term "gastrectomy" should be understood the removal of the entire stomach; but as recent investigations have seemed to indicate that it is impossible to distinguish a well-marked boundary-line between the epithelium of the stomach and œsophagus, it is difficult to say when the entire organ is removed. Probably a considerable number of cases that have been reported as total removals of the stomach have, in reality, been only partial gastrectomies. The operation may possibly be indicated in cases of very extensive malignant growths which have not in-

volved or become extensively adherent to neighboring organs and which have not caused metastases. It should certainly be performed only in the rarest and most unusually favorable cases, and only by surgeons of skill and wide experience in abdominal surgery. Sufficiently extensive operations to deserve the name of total gastrectomies have been performed in 11 cases, with 5 recoveries. Death resulted from recurrence of the growth in the case of 2 of these patients and from peritoneal infection in a third. No reports of the later results have yet been given in the other 2 cases.

*Operation.*—The gastro-colic and gastro-hepatic ligaments are first tied and divided; then, after carefully packing gauze about to prevent possible peritoneal infection, the pyloric end is divided from the duodenum between double clamps; the œsophageal end is then divided in a similar manner. In several cases the duodenum has been found sufficiently movable to make an anastomosis with the œsophagus. This was done, in the cases of two patients that recovered, by means of a Murphy button. If it is impossible to bring the duodenum up to anastomose with the œsophagus, the end of the duodenum is closed and a loop of jejunum is brought up and an end-to-side anastomosis with the œsophagus is made.

Study of the metabolism in Schlatter's case of total resection of the stomach. Six and a half months after the operation the patient had gained 5.4 kilogrammes in weight. The amount of nitrogen present in the stools varied within normal limits, but during the six days a complete nitrogenous balance was not obtained as occurs in health. There was a retention of from 1 gramme to 1.4 grammes of nitrogen. This retention is known to occur in convalescence from acute illnesses, etc. There was no in-

crease in weight during the first period of observation. A month and a half later a further investigation was made with a more varied diet, and here the absence of the stomach seemed of no importance. A nitrogenous balance could now be established, showing that the regeneration of the blood was so far complete that there was no longer any need of retention of nitrogen. The retention of phosphorus was also marked. Fatty matters were satisfactorily dealt with, so that of 8.5 grammes taken only 4.64 grammes were excreted.

The absence of the hydrochloric acid in this case was without influence upon putrefactive processes in the alimentary canal.

As regards the quantity of chlorides in the urine, there was no decrease after the chief meal in this case. This confirms the current view that the diminution of the chlorides in the urine after a meal is due to the hydrochloric acid excreted by the stomach. The absolute acidity of the urine was higher in this case than in ordinary individuals. The retention of sodic chloride was striking, without there being any increase in the body-weight. There was no relationship between the excretion of chlorides and the acidity of the urine in the different periods of the day. Hoffmann (Münch. med. Woch., May 3, '98).

(See also ABDOMEN, INJURIES OF, volume i.)

Case of removal of the entire stomach for carcinoma by successful œsophagoduodenostomy. The patient was a woman of good constitution, aged 66.

On opening the abdomen the tumor was found to comprise nearly half of the wall of the stomach; there was no marked glandular involvement or adhesions, and it was determined to remove the whole organ. The greater and lesser omentum were tied off and divided; the duodenum was clamped and a ligature was placed around it half an inch above the clamp, and the tissues were divided between the two. The ends were washed in salt solution and wrapped in iodoform gauze. The same method was employed with the œsophagus and the cardiac end of the stomach. It was found that the

œsophagus and duodenum could be brought together, and they were united by a Murphy button to shorten the operation. No Lembert sutures were applied, as the approximation was good. The peritoneum was closed by catgut suture and the abdominal incision by silk-worm gut. There was practically no loss of blood. The operation lasted two hours and a quarter, and was followed by a considerable amount of shock. The patient, however, made a complete recovery. Where there are no adhesions, removal of the stomach is not very difficult; with ordinary care hæmorrhage is not likely to occur. The effect of surgical shock upon the patient is most to be feared, and should be guarded against by heat, stimulants, and quick work in operating. C. B. Brigham (Boston Med. and Surg. Jour., May 5, '98).

Complete gastrectomy in a patient 56 years of age. At the time of the report fully nine months have elapsed since the operation was performed.

The patient has gained 8¾ pounds in weight, is engaged all day long at work of various kinds in the wards of the hospital, and suffers no discomfort, excepting a sensation of pressure or tension in the epigastrium after the ingestion of an unreasonable quantity of food. Palpation through the relaxed abdominal walls fails to reveal anything suggestive of recurrence. Carl Schlatter (Lancet, Nov. 19, '98).

Instance of successful removal for epithelioma of the pylorus together with adjacent portions of omentum which contained two glands in a state of advanced cancerous degeneration. This case shows the fallacy of view that cancer of the stomach is a localized disease, and has but slight tendency to invade the lymphatic system. The pathological investigations of Cuneo in a great number of cases of cancer of the stomach have never failed to show glandular degeneration. It is necessary, therefore, in removing the pylorus for malignant disease, to also take away the adjacent portions of omentum and the included lymphatics. Poirier (Bull. et Mém. de la Soc. de Chir., Jan. 2, 1900).



Another successful case of gastrectomy added to the four previously reported by Schlatter, of Zurich; Brigham, of San Francisco; MacDonald, of San Francisco; and Richardson, of Boston. In less than six weeks she left the hospital apparently perfectly restored, after taking a dinner consisting of roast beef, mashed potatoes, ice-cream, milk, and coffee. On admission to the hospital her weight was 79 pounds; three months later it was 100 pounds. On returning to her home she immediately assumed the responsibility of her household work. Harvie (*Annals of Surgery*, Mar., 1900).

Malignant disease of the stomach begins in most instances near the pylorus just below the lesser curvature. From this point it spreads most widely and most rapidly in the submucosa. The rate of growth toward the cardiac orifice is rapid, toward the duodenum very slow. The duodenum is rarely affected extensively. The tendency of the growth is to drift toward the curvatures.

The lymphatic system of the stomach consists of (a) an area along the lesser curvature; (b) an area along the greater curvature, and (c) an "isolated" area, over the greater tuberosity and lower end of the œsophagus. The author reports a case of partial gastrectomy performed along these lines. While the patient died 312 days after the operation, yet he was relieved of all the local growth, and the operation was not followed by any recurrence in the stomach or duodenum. The cause of death was secondary growth in the lungs and liver. B. G. A. Moynihan (*Brit. Med. Jour.*, Apr. 25, 1903).

### Surgery of the Intestines.

#### Preliminary and General Measures.—

For a few days before operation careful attention should be given to the patient's general condition; especially as regards the diet, which, in some cases, should be restricted to fluids. The use of intestinal antiseptics is of some value; the intestinal tract should be thoroughly emptied, if possible, by the administration of purgatives and by the use of ene-

mata. Washing out the stomach a short time before the operation also assists in preventing vomiting and retching.

Inasmuch as the shock following some of the severe intestinal operations is great, it is important to make use of such prophylactic measures as are likely to lessen it as much as possible. The administration of some form of alcoholic stimulant by the rectum *before* the operation and the hypodermic injection of strychnine,  $\frac{1}{20}$  grain, insures their absorption, while, if we wait until after severe shock is present, we often fail to get the full effect of the drugs. The administration of an intravenous infusion of salt solution during the operation is of great value. It is, of course, of first importance to provide such efficient protection and to make use of such other measures as will keep up the body-heat.

The anæsthetic should be administered with special care, not only because of the immediate danger, but to avoid after-vomiting and retching. In severe operations a considerable quantity of warm salt solution, left within the abdominal cavity, is an aid in combating shock.

In the after-treatment of patients who have undergone grave intestinal operations it is questionable whether morphine should be administered except to relieve the immediate pain; it often tends to aggravate the intestinal distension and paresis of the bowel which frequently follow abdominal operations. The administration of a mild saline cathartic to produce daily liquid evacuations of the bowel helps to avoid stasis and distension in severe cases. Rectal feeding does not stimulate peristalsis as much as food administered by the stomach. A supporting stimulating liquid diet is desirable during the first few days.

**Enterorrhaphy.**—This term is ap-



plied to the operation of suturing the intestine; it has also been used to designate the operation of joining the ends of the intestine after resection, but "intestinal anastomosis" is a better term for the latter (see below). End-to-end union is termed circular enterorrhaphy.

As suture material, fine silk is almost universally used. Catgut, although recommended by some surgeons, swells and stretches and is absorbed too quickly. The needles employed should be round, with no cutting edges, ordinary straight sewing needles being the best for intestinal work. The methods of suture which have been employed are many, but the following are in general use and suffice for all ordinary purposes.

In the *Lembert suture*, the needle is introduced through about a third to a half centimetre of the intestinal wall on one side of the wound; it is then carried across the wound and introduced in the same way. When drawn and tied this suture brings the serous surfaces into close apposition.

Halsted has shown the importance of carrying the needle through not only the serous and muscular coats, but also into the tough submucous coat. The *Lembert suture* may be interrupted or continuous, when it is sometimes called *Dupuytren's suture*. The *Czerny-Lembert suture* is a modification of the *Lembert* and is really a *Lembert suture* in two stages: the first introduced at the edges of the wound through the mucosa, while the second suture serves to invaginate and bury the first.

In *Halsted's mattress-suture* the needle is first introduced as in the *Lembert suture*, then is entered again on the same side of the wound a short distance from its point of exit; it is introduced in the same manner as the *Lembert stitch*, but passes in the opposite direc-

tion, thus bringing both the ends of the suture out on the same side of the wound with a loop on the other side; this, when the suture is drawn down, gives a very strong hold on the tissues. The advantages claimed for this suture are that they oppose larger surfaces and more evenly, that they do not tear out as easily and constrict the tissues less than the *Lembert suture*, and that time is saved by lessening the knots to be tied by one-half.

Whatever method is chosen it is important that the serous surfaces be brought into apposition and that the blood-supply of the intestine be studied. The sutures should be so placed that vessels shall not be injured or compressed, in order that the circulation be as perfect as possible.

**Intestinal Anastomosis.**—This term is used to designate the operative establishment of communication between different parts of the intestinal tract, whether the section of gut intervening has been removed or not. The terms *entero-enterostomy*, *ileo-ileostomy*, *ileo-colostomy*, etc., are generally used to mean the creation of intestinal anastomosis for the purpose of making a short circuit between healthy intestine above and below, the intervening portion of bowel being left because it cannot be removed or because it is not advisable or not necessary to remove it.

*Entero-enterostomy* may be performed for carcinoma of the intestine, stricture, agglutination by peritoneal adhesions, for the cure of artificial anus, intestinal ulceration, or other conditions in which it is desirable to put a section of intestine at rest or to avoid intestinal obstruction. It is a procedure of less gravity than resection, and is often preferable to colostomy or the establishment of an artificial anus when the condition of the

patient permits. The best results from the operation are seen when it is performed for unremovable agglutination of the intestinal coils by adhesions. It may be performed by simple suturing or by the aid of various mechanical contrivances which have been devised for intestinal anastomosis.

**MECHANICAL DEVICES TO AID IN INTESTINAL ANASTOMOSIS.**—In addition to the method of anastomosis (uniting the intestines directly by suture), many mechanical means have been devised to aid in the rapidity and accuracy of the procedure, such as buttons, bobbins, cylinders, collapsible bulbs, anastomotic forceps, etc. The most commonly used of these is the Murphy button. In using the *Murphy button* a purse-string suture is put around each of the openings which it is desired to anastomose, beginning at the point farthest from the mesentery and taking one overstitch at the mesenteric junction to make certain that both layers of the peritoneum overlap. Each half of the button is introduced by forceps into the bowel, and the puckering sutures are tied closely upon the stems; the halves of the button are then locked by pushing them together. If the bowel is properly gathered around the stems, the flanges, pressed together by the spring inside, will keep up an accurate apposition of the serous surfaces of the bowel. The chief advantage of the Murphy button is the rapidity with which it can be used; the disadvantages are the possibility of imperfect union, with resulting leakage of intestinal contents and septic peritonitis and the possibility that the button may not pass from the intestine, but may give rise to ulceration or intestinal obstruction.

With no other method of intestinal approximation can be obtained all the desired conditions in such ingenious combination as with the mechanical de-

vices of the Murphy type. The chief advantages of such devices are, it is stated: (1) simplicity of application; (2) saving of time; (3) uniform coaptation of the peritoneal surfaces of the entire circumferences of the approximated ends; (4) prevention of bleeding at the seat of approximation; (5) a cicatrix that will not contract to a serious degree; (6) exact juxtaposition of histological structures; (7) minimizing of risk of infection, as no needle is used to carry infection from the intestinal canal into the peritoneal cavity. There is also a reduction of mortality. According to statistics with mechanical methods of the Murphy type, the mortality in gastro-enterostomy for non-malignant disease ranges from 2.5 to 14 per cent., in end-to-end union from 10.5 to 16 per cent.; and is only as high as 33 per cent. in malignant cases. With the suture methods the mortality ranges in gastro-enterostomy from 24.5 to 76.47 per cent., and in end-to-end approximation from 58 to 100 per cent. Frank (*Annals of Surg.*, Jan., 1902).

The *anastomotic forceps* which were devised by Laplace, and have since been modified by Downes and others, offer a means of rapidly and accurately suturing without leaving any foreign substance within the gut. The forceps resemble two pairs of hæmostatic forceps held in apposition by a clasp. The blades of each half are semicircular in shape, together forming a complete double circle, between which the portions of intestine to be united are held. If the serous surfaces of the intestine do not tend to invert over the blades as the forceps are closed, they should be adjusted so that this will be accomplished. Continuous or interrupted sutures may be applied according to the preference of the operator. After the sutures are inserted the clamp is removed; first one-half of the forceps is carefully opened and removed, then the other is removed in the same manner.



One or two sutures are sufficient to close the opening occupied by the forceps and complete the operation.

A new forceps for intestinal anastomosis may be described as follows: The forceps consists of two parts, which are really hæmostatic forceps, curved into a semicircle on each side. Being only held together by means of a clasp, they open as two rings. They are opened within the intestine, and serve the same purpose as Senn's rings or any other ring that has been devised, bringing serous membrane to serous membrane. Accurate suturing is the operation of the present. Therefore, if these forceps are within the gut, and sutures are applied, as they would be with the help of Senn's rings, it follows that sutures are introduced all around, except where the forceps penetrate the parts that are sutured. The suturing being done, the forceps are released by loosening the clasp, and then withdrawing the forceps out of the small opening; first one-half, then the other, when the operation is finished by a stitch or two. This forceps will serve for the operation of end-to-end anastomosis and also of lateral anastomosis. Ernest Laplace (*Annals of Surg.*, Mar., '99).

Original forceps for making intestinal and visceral anastomoses. The instrument is a small one and possesses the advantage of requiring no additional instrument or even the hands of an assistant to prevent contamination of the wound surfaces with fæcal matter during the anastomosis. M. O'Hara, Jr. (*Annals of Surg.*, Feb., 1901).

In the use of *Senn's decalcified-bone plates* or the various rings of catgut, raw-hide, etc., which have been employed, the plates are introduced into the opening which it is desired to anastomose, threaded with four needles, and the sutures are passed out through all the coats of the bowel a little way from the edges of the intestinal openings. The intestinal surfaces are usually gently scarified to accelerate union; the ligatures in the plates are tied with the in-

testinal walls invaginated between them, and a reinforcing continuous suture, inserted over the edges of the rings or plates, completes the operation.

*Maunsell's Method.*—In this procedure two temporary sutures are employed to make preliminary approximation; these are tied and the ends left long. A longitudinal incision an inch and a half long is made in the larger segment of intestine opposite the mesentery and two inches from the divided extremity. Through this opening a pair of forceps is passed, the free ends of the sutures are caught, and the cut ends of the bowel are brought out through this opening. The two temporary sutures are held while the ends of the intestine are united by through-and-through suture. The temporary sutures are then removed, the invagination reduced, and the edges of the longitudinal incision are closed by Lembert sutures.

*CHOICE OF METHOD.*—Various positions for anastomosis have been advised by different surgeons, some preferring end-to-end, others end-to-side, and still others side-to-side junction. There is nothing to prove that lateral approximation is more successful in its immediate or remote results than end-to-end junction, and a good deal of time must be given to the closure of the free ends in case side-to-side anastomosis is performed; this time is superadded to the methods of end-to-end junction. End-to-side junction is the natural and preferable method of joining the small bowel to the large bowel, and may be also used in case there is great contraction above the line of resection with enormous distension below. Lateral anastomosis is probably preferable to end-to-side anastomosis in most cases in which considerable difference exists in the calibre of the proximal and distal ends of the same kind of intestine. Other factors which

are considered by some surgeons to be of considerable advantage in lateral anastomosis are that larger serous surfaces are opposed, giving greater likelihood of rapid and firm union and that there is less danger of stenosis at the site of anastomosis resulting from this method.

Most surgeons consider the method of suturing without leaving mechanical devices in the intestine the preferable one for the majority of cases. The use of Laplace's anastomotic forceps greatly facilitates the accurate and rapid insertion of intestinal sutures, if it seems necessary to complete the operation with the least possible loss of time because of the weakened or collapsed condition of the patient. In certain cases in which union by suture would be inconvenient or impossible, junction by means of Murphy's button is the most rapid and convenient method. When lateral anastomosis is considered desirable many surgeons prefer to accomplish it by the use of Senn's decalcified-bone plates or by some of the catgut rings, cartilage, turnip, or potato disks which have been devised as a substitute for them.

**Enterotomy and Enterostomy.**—"Enterotomy" is the term used to designate the operation of making an opening into the bowel through which its contents may be discharged or temporary access to its interior is gained. The name should be retained for incision and evacuation of the intestinal contents with immediate or early closure of the opening. When the opening is kept patent for a considerable length of time "enterostomy" is the better term. These names may be applied to operations in any part of the intestinal tract, but the names colotomy and colostomy are generally used when the operation is performed on the colon.

**INDICATIONS.**—These operations are

practically always performed for the relief of some form of acute or chronic intestinal obstruction. They may be performed in cases in which there is danger of death from great intestinal distension, vomiting, or toxin poisoning, without relieving the source of obstruction. In other cases in which the cause of obstruction has been removed, the operation may be desirable because of the great intestinal distension. It may also be performed if there is doubt as to the vitality of the intestine. In malignant disease it is often inadvisable to remove the growth, but necessary to relieve the obstruction, and in some cases the operation is desirable to prevent the irritation of faeces passing over the growth, or the hæmorrhage which occasionally results from this source. As a curative measure colostomy has been performed in cases of simple ulceration of the rectum in which other means have failed. It has also been performed for the relief of excessive distension arising from atony of the walls of the intestine and for the cure of recto-vesical fistula. In case of imperforate anus the operation is indicated, provided it is impossible to open the bowel from below.

**OPERATION.**—The parietal incision is made over the obstruction, or as nearly so as possible. The intestinal coil is drawn through the wound and isolated by packing. In case of urgent necessity a simple incision about an inch in length is made at the free border of the gut, after sewing it in the abdominal wound to prevent peritoneal infection. If a case is not urgent, it is desirable to wait twelve hours or more in order that firm adhesions may form. If it is desired to make permanent drainage, a rod of some smooth aseptic material may be passed through the mesentery resting on the abdominal wall, as in Maydl's operation.



**Colostomy and Colotomy.**—The colon has been opened both through an incision in the lumbar region and directly through the abdominal wall. Before the introduction of antiseptic technique lumbar colotomy was the preferable operation, because the posterior wall of the colon is not covered with the peritoneum and it is possible to make an opening into it without danger of infecting the peritoneal cavity. The disadvantages of *lumbar colotomy* are: it is more difficult to find the colon through the deep lumbar incision; the bowel is less efficiently drained; and fæces passing over the fresh incision tend to produce infection and suppuration. For these reasons the operation has been abandoned by nearly all surgeons, and will not be described.

*Maydl's Colostomy.* — The method introduced by Maydl is generally considered the simplest and best. The parietal incision may be made at any part of the abdomen which is over the colon, but, as a rule, the descending colon is opened. It is desirable to place the opening in such a position as to be convenient for the patient in the toilet of the artificial anus. About an inch behind the line of the antero-superior spine and an inch above it is a good point to begin the lower end of the incision, which should be only long enough to permit the bowel to be drawn out. The fingers inserted through the abdominal incision usually come in contact with the colon at once, but, if it is not easily discovered, the finger may be carried along the posterior abdominal wall until the mesocolon, which will be the first structure met, is encountered. The bowel is then pulled down from above to make taut the splenic flexure, and is drawn from the wound far enough so that a stiff rod may be passed through

its mesentery. Any smooth stiff antiseptic material will answer, but a glass rod with flanged ends is generally preferred. Iodoform gauze is wrapped around the ends of the rod to prevent displacement; a row of sutures is placed on each side of the prolapsed intestine, including the serous and muscular coats, stitching together the two limbs of the flexure as they lie in the abdominal wound beneath the rod. The intestine is then sutured in the parietal wound to shut off the peritoneal cavity and to prevent protrusion. The intestine may be opened immediately if the symptoms are urgent, but it is perhaps best to postpone opening it a few days until firm adhesions have formed. If the opening is to be temporary, only about a third of the periphery of the bowel is divided. If a permanent opening is desired, the bowel is cut on a level with the supporting rod. Sufficient mucous membrane should be left to form a pouting anus, at least one-half inch above the level of the abdominal wall. With such a protruding anus it is easy to collect the fæces with a cup-shaped apparatus; while, if the bowel is cut close to the abdominal wall, fæces run over the skin, and there is nothing to aid in holding the receptacle.

**Intestinal Resection, or Enterectomy.** — These terms are used to designate the removal of a section of any part of the intestine, but “colectomy” or “cæcectomy” is sometimes used to designate removal of the colon or cæcum.

**INDICATIONS.**—Resection of the bowel may be performed for removal of malignant or benign tumors, for gangrene, for extensive wounds and injuries, in some cases of artificial anus, irreducible intussusception, and occasionally in cases of obstruction from cicatricial adhesions or simple stricture.



*Intestinal gangrene* usually arises from some form of obstruction caused by internal or external strangulation. A few inches may be involved or several feet, or even the whole intestine. The line of demarkation from sound tissue may be distinct, or the gangrenous area may merge into extreme congestion without any definite limit. Whether resection should be performed or an artificial anus established will depend upon the condition of the patient, the extent of the gangrene, and the condition and location of the gangrenous area. Complete necrosis of a few inches, with healthy bowel beyond, if the patient is in good condition, may always be treated by resection. On the other hand, if an extensive area is involved, with imperfect limitation or with unhealthy bowel beyond, and if the patient is very ill, it may be best to form a temporary artificial anus. A discussion of the etiology and symptoms of gangrene from various causes will be found under the headings of OBSTRUCTION, INTESTINAL, and THROMBOSIS OF THE MESENTERIC BLOOD-VESSELS. The same remarks apply to the cause of obstruction.

Experiments on animals led Senn to conclude that the resection of more than one-third of the intestinal canal was productive of a fatal marasmus. Trzebicky maintains that one-half of the intestinal tract may be resected without a fatal issue. Monari has removed seven-eighths of the intestine of the dog without seriously interfering with metabolism. The writer studied the subject from a clinical standpoint. Including the case reported in the present communication he has collected 33 instances in which more than one metre of intestine has been removed. Nine died soon after operation and 3 after four months. In the 21 surviving, the part resected consisted of colon in 2, of ileum and jejunum in 1, and of a portion of the ileum in the remaining cases.

In the 7 cases which showed digestive disturbances subsequent to operation, the length of intestine removed, with 2 exceptions, was over 200 centimetres (6 feet 6½ inches). The 14 which showed no untoward symptoms lost less than 200 centimetres, with one exception in which 205 centimetres were removed. From these statistics the author concludes that 200 centimetres, or less than one-third of the total length of the intestine, is the danger-limit. Children stand extensive resections better than adults; and the loss of intestine is more serious the nearer one approaches the stomach. Alexander Blayney (Brit. Med. Jour., Nov. 16, 1901).

*Tumors of the Intestine.*—An absolutely certain diagnosis of a tumor of the intestine is usually quite impossible at an early stage of its development. Hence, as malignant growths within the peritoneal cavity involve important structures so rapidly and so early, an exploratory operation should be immediately resorted to in any case of intestinal disturbance in which there is rapidly developing cachexia which leads to the suspicion of a malignant growth. Resection of the growth, if possible, is always the operation of choice, but, in case it has progressed too far, entero-anastomosis or the establishment of an artificial anus may be considered.

*Syphilitic tumors* give rise to the same symptoms as other new growths, and the diagnosis would depend upon the history and observation of the general constitutional symptoms of syphilis.

*Intestinal tuberculosis*, through ulceration, inflammatory thickening, and contraction, gives rise to symptoms similar to those produced by new growths. Young persons are more commonly affected, and frequent attacks of colic are quite characteristic. The ileo-cæcal region is most commonly affected. The disease leads frequently to perforation and acute suppurative peritonitis or to the forma-

tion of a fistula. The clinical picture of tuberculosis in the ileo-cæcal region often resembles that of recurrent appendicitis or that of a tumor in this region.

**THE OPERATION OF INTESTINAL RESECTION.**—The parietal incision is usually made directly over the portion of intestine about to be removed or just above it. But for resection of the small intestine the incision should never be much below the umbilicus and in most cases would preferably be above it, for greater freedom will be gained in bringing the bowel out of the incision if it is made nearer the mesenteric attachment, which is above. An exception is found, of course, in cases of gangrene from strangulated hernia in which the incision is made directly over the seat of strangulation. For excision of the cæcum an incision in the line from the antero-superior spine toward the costo-spinal angle will be most convenient. The first part of the incision is best made short; then after the growth is examined it may be prolonged in the direction which is likely to prove most satisfactory for its removal.

In case of grave operations an incision sufficiently extensive to give free access to the field of operation is essential. After opening the abdomen the bowel should be brought out of the incision and surrounded with gauze pads wrung out of hot, sterile, salt solution, the pads being changed as soon as they cool. The growth should be carefully examined before proceeding to remove it. In case of malignant disease resection is usually considered contra-indicated if the mesenteric glands, except in the area attached to the bowel, are affected. König, however, has reported several very extensive operations in which the growth had involved surrounding tissues, and in

which removal was not followed by recurrence for two years or more. The intestinal contents should be pressed away from the area of operation so as to leave the intestine collapsed and empty. The portion to be resected should then be isolated by means of some form of intestinal clamps. The blades of the latter are usually covered with rubber tubing to minimize the risk of injury, and they should be placed obliquely in the direction of the blood-vessels, so as not to damage them. If no clamp is available, a flat sponge may be folded around the bowel and a ligature tied over it, after perforating the mesentery. Two strips of iodoform gauze are also very efficient and always at hand. Two clamps are usually sufficient, except in operations on the colon, which it is difficult to empty. In this case a clamp is placed on each side of the line of incision and the bowel divided between. The mesentery is cut as near the bowel as permissible, instead of in a wedge-shaped piece, as has been sometimes recommended, as this involves less division of the vessels and smaller risk of gangrene. Sharp-pointed forceps are desirable in seizing blood-vessels of the intestinal walls in order to avoid unnecessary crushing. It is specially important to determine with certainty that the intestine is abundantly supplied with blood through the mesenteric vessels on each side of the resected area. If the blood-supply is doubtful it is much better to resect a larger piece of intestine until a good blood-supply is found. After the diseased area is removed the ends of the intestine may be united by simple suture according to any of the methods mentioned under intestinal anastomosis, or by the aid of such mechanical means as may be considered desirable. Greig-Smith recommended that in case of malignant growths causing



considerable obstruction, an artificial anus be first established and the bowel thoroughly unloaded, flushed, and cleansed. Then the resection may be performed at a subsequent operation.

**Mortality.**—The mortality after resection for gangrene will depend upon the condition of the patient and the bowel at the time of operation: it has been estimated at from 12 to 50 per cent. The mortality after operations for malignant growths has been high, very likely because of the weakened condition of the patients: it has been estimated at from 23 to 50 per cent. Probably the average mortality is not over 30 per cent. if all cases were included, and it may be hoped that, with more careful methods of diagnosis and the more frequent resort to early exploratory operation, the results will be much improved.

The writer has collected 151 cases of intestinal resection operated on since 1880, tabulated as follows:—

Hernia .....	42	times	with	a	mortality	of	40.5	per	cent.
Artificial anus...	44	"	"	"	"	"	43.2	"	"
Neoplasms .....	28	"	"	"	"	"	46.5	"	"
Obstruction .....	21	"	"	"	"	"	48.0	"	"
Wounds.....	16	"	"	"	"	"	37.5	"	"
Total.....	151	"	"	"	"	"	42.3	"	"

Rosenthal (Wiener med. Presse, Nos. 12, 18, 21, '92).

Series of twenty-six cases of enterectomy divided into three classes: 1. Those operated on by simple suture, 9 in number, of which 5 died, yielding a mortality of 55.5 per cent. 2. Those operated on by the Murphy button, 5 in number, of which 1 died, giving a rate of mortality of 20 per cent.; 2 had had fistulæ and a retarded convalescence, and in 1 the button had not passed while the patient was under observation. 3. Those in which a decalcified-bone support in the shape of a button or some similar contrivance was employed to support the sutures, of which there were 12 cases with 1 death, giving a rate of mortality of 8.3 per cent. Mayo Robson (Brit. Med. Jour., Apr. 4, '96).

Case of a feeble woman, aged 76, who suffered from strangulated ventral hernia. In this case it was found necessary to excise  $5\frac{1}{2}$  feet of small intestine, after which an end-to-end anastomosis was made. The patient made a satisfactory recovery, the wound healing without trouble. Subsequent to the operation there was some slight diarrhœa, which was easily controlled. It is preferable to remove a strangulated portion of bowel, the vitality of which is questionable, rather than to return it with the possibility of subsequent local complications. A. E. Barker (Lancet, Apr. 27, 1901).

**Operations for Perforating Ulcers of the Intestine.**—Ulceration of the intestine, which leads to perforation demanding operation, may arise as a consequence of typhoid fever; the presence of foreign bodies, particularly in the colon; or from a typical round duodenal ulcer. Tuberculosis and malignant disease may also ulcerate and give rise to perforation.

**Perforation in typhoid fever** is probably the most common form of intestinal perforating ulcer. It is said to occur in 6.58 per cent. of all cases; it is much more frequent among men than among women, and is comparatively rare in children. The lower portion of the ileum is most commonly affected; but the large intestine and (rarely) the appendix, jejunum, and Meckel's diverticulum may also be perforated. The perforation is usually single, and, if it results from the ulceration of a solitary follicle, it is generally small and round. Perforation of a Peyer patch is apt to be larger, with a considerable thinned area surrounding. There seems to be no definite relation between the severity of the disease and perforation. About a fourth of the number of cases occur in the course of a mild attack, and others occur during walking typhoid. The symptomatology is fully discussed under TYPHOID FEVER.



*Indications for Operation.*—Ninety-five per cent. of all patients die without operation, and, unless the condition of the patient is absolutely hopeless, an attempt should be made in every case. Healing usually follows as well as if the patient were not suffering from the fever, and a number of patients have recovered after repeated operations. The earlier the operation can be done, after the immediate shock of the perforation, provided there has been any, the better the chances of recovery. Every hour counts, since the infection of the peritoneum rapidly becomes more diffuse and intense.

Surgical intervention offers practically the only hope in cases of perforation occurring in typhoid fever. There are two varieties of perforation,—appendicular and those occurring in the free bowel; and these present different courses and prognoses. Many cases show a preperforative stage in which some cases call for a laparotomy in anticipation of a complete perforation with extravasation. Leucocytosis is not an infallible sign of perforation. When the diagnosis is made, operation is indicated, whatever the condition of the patient. Even exploratory incision is more than justified. Harvey W. Cushing (Johns Hopkins Bull., Nov., '98).

*Operation.*—Incision is best made in the right semilunar line or through the rectus muscle. If there is any doubt as to the diagnosis, a small exploratory incision may be made under cocaine, which is enlarged if the perforation is found. The perforation should be sought first in the ileum and in the adjacent cæcum and appendix, and secondly in the sigmoid flexure and higher up in the small intestine. The perforation should be sutured without paring the edges, using Halsted's mattress-suture, and, if a second row of sutures is thought necessary, continuous suture saves time. In case of a large perforation the suture should

be placed transversely to the long axis of the intestine if possible, in order to avoid constricting the lumen of the gut. Resection of the intestine has been performed successfully in several cases in which extensive damage was found. Other perforations or points of impending perforation should be sought and sutured: deaths have followed from a second perforation or hæmorrhage in several cases in which this precaution was neglected. The cleansing of the peritoneal cavity is the subject of next greatest importance, and should be carried out with the greatest thoroughness. Whether it shall be done by flushing or wiping, or both, must be decided by the operator at the time of the operation. Drainage is necessary in most cases, but if the peritonitis is not of long standing and the abdominal cavity can be satisfactorily cleansed, the abdominal cavity may be filled with salt solution and closed. Cushing has recently advocated the use of cocaine infiltration anæsthesia instead of general anæsthesia. This is unquestionably a step in advance, for, in the weakened condition of the patient, general anæsthesia is not borne well.

The rate of mortality of this procedure has greatly improved during the past few years. The recovery-rate of all cases thus far reported is 22.72 per cent. It is more favorable under fifteen years, in the female sex, and in the fourth week of the disease. Of the series of 75 cases last reported, 54 died and 21 recovered: a recovery-rate of 28 per cent., a considerable gain over the previous rate. If physicians were aware of the good results of operation and if they called the surgeon promptly no doubt the number of successes would be even greater.

*Perforating Duodenal Ulcer.*—This condition is comparatively rare. The ulcer is usually found in the first part of

the duodenum, more commonly on its anterior wall, and may be associated with other disease. The symptoms are practically identical with those of perforating gastric ulcer. There is the same history of hæmatemesis, dyspepsia, and vomiting, followed by severe abdominal pain and collapse.

The treatment consists in suturing the ulcer and thoroughly cleansing the abdominal cavity, as described in the treatment of perforating gastric ulcer.

**Perforating stercoral ulcer** occasionally results from a foreign body, usually with some sharp projecting part, lodging in the colon. The foreign body gives rise to inflammation and the formation of adhesions, and when perforation takes place the infection is usually localized and tends to the formation of an abscess, which should be treated by incision, cleansing, and free drainage.

**Thrombosis of the Mesenteric Blood-vessels.**—Judging from the meagre literature on this subject, thrombosis of the mesenteric vessels is relatively infrequent, and no account of it is to be found in most of the standard textbooks. Koester has collected fifteen cases, and several have been reported since. The causes have been variously sought in ulceration of the intestines, slowing of the portal circulation, the presence of carcinoma or cirrhosis of the liver, and sclerosis of the vessels from syphilis. The onset of the disease may be sudden, during perfect health, or it may occur during recovery from some severe illness. Invariable symptoms are intense abdominal pain, extreme tenderness, and vomiting. There is often obstruction of the bowels and collapse, and, if the patient survives the shock, abdominal distension occurs; in a limited number of cases bloody diarrhœa has been observed. Death usually fol-

lows soon, possibly within a few hours, but in a case reported it was delayed for three days. The differential diagnosis of the condition would take into consideration perforative peritonitis, acute intestinal obstruction, and possibly appendicitis. An absolute diagnosis is probably possible, but the symptoms are such as to indicate immediate operation.

Recovery has followed resection of the affected portion of the intestine.

#### **Operations for Intestinal Obstruction.**

—Inasmuch as practically all patients die unless they are operated upon, operation is indicated in every case in which there is a reasonable certainty of the diagnosis. In case of doubt one dose of purgative medicine may be administered and enemas may be freely given without harm. If there is a probability of acute intestinal obstruction, however, not more than one full dose of purgative should be administered, for such remedies may do decided harm. If the symptoms persist and the diagnosis is still doubtful, prompt exploratory operation is indicated. (See OBSTRUCTION, INTESTINAL, in volume iv.)

**OPERATION.**—The amount of operative intervention will depend upon the condition of the patient. Very commonly the surgeon is called in late and the patient is in a much weakened and collapsed condition; in such cases the use of a general anæsthetic is full of danger, for vomiting is almost certain to occur, and the vomited fluids are likely to be drawn into the lung, causing death by suffocation or by subsequent broncho-pneumonia. In such urgent cases the operation is best performed with local anæsthesia. The incision should be made in the median line below the umbilicus, unless there is considerable certainty as to the location of the obstruction, in which case the in-



cision may be made over the site of the obstruction. Only a short time should be devoted to exploration; if the cause of obstruction is not found an artificial anus should be made, which will put the patient for the time out of danger, and the operation may be completed at a later date. The first object is to save the patient's life. In seeking the site of obstruction it should be remembered that the most dilated coils are above the obstruction and will rise nearest to the surface, usually near the umbilicus, and by following the most distended and congested portion of the intestine the stricture will generally be found. If the obstruction is not found in this manner, the hand may be inserted. If the cæcum is first examined and found distended, the cause of obstruction is probably located lower down in the colon; if not distended, the seat of obstruction is sought in the small bowel. The measures taken for relief of constriction will depend upon its cause and upon the condition of the bowel. A volvulus should be untwisted, the mesentery shortened, and intussusception reduced by drawing the invaginated portion out. The treatment of intussusception by inverting the patient and by injecting large amounts of gas or fluid in the colon has not given very satisfactory results, and, unless immediately successful, operation should not be delayed.

If there is excessive distension of the bowel it will be necessary to relieve it after removing the cause of obstruction. This may be done by one or more incisions, carefully protecting the abdominal cavity by packing gauze about the opening, which should be closed at once by Lembert sutures. In some cases in which the intestine is found gangrenous resection may be necessary.

Very excessive distension would sometimes call for the formation of a temporary artificial anus. In the after-treatment opium should be avoided, as it tends to paralyze the bowels, causing distension and checking all the secretions. If gas or fluid is not passed and the distension does not diminish, the abdomen should be reopened and enterotomy performed. Rectal feeding may be necessary for several days until food is well borne by the mouth.

In chronic intestinal obstruction the treatment will depend on the number and severity of the attacks. If the general health of the patient is suffering, operation is indicated.

In chronic obstruction due to stricture or tumors resection may be possible; but, if malignant growth has progressed too far to admit of this, enterostomy or colostomy is indicated. In the case of foreign bodies, such as gall-stones, it is sometimes possible to break them up, by pressure or by needling, or to pass them along after the abdomen is opened without opening the intestine. As a rule, however, it is best to extract the body through the incision. (See also APPENDICITIS and ABDOMEN, INJURIES OF, volume i.)

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## STOMACH, DISEASES OF.

### Acute Gastritis.

**Synonym.**—Acute gastric catarrh.

**Symptoms.**—The chief symptoms of acute gastric catarrh are loss of appetite, a heavily-coated tongue, foetid breath, perhaps increased salivation, nausea, and usually vomiting, which last, if persistent, is associated with considerable thirst. There may be constipation or diarrhœa; the fæces are of an offensive odor. In



mild cases fever is absent; in the more severe forms, present. Headache and lassitude are usual, and herpes may appear on the lips in the course of the malady. The abdomen is usually distended with gas and the epigastrium somewhat tender to pressure. Acute pain is often present in the more severe forms. The duration of an attack is variable, but is rarely over a week. The urine is febrile, high colored, scanty, and deposits large amounts of urates. The vomit consists at first of partly-digested food, and subsequently of bile-stained mucus and of bile. An examination of the vomit usually shows absence of free HCl, with diminution in the amount of pepsin and of the labferment. There are apt to be present, as the result of stagnation of food in the stomach and diminution or absence of secretion of HCl, various organic acids, such as lactic, butyric, and especially acetic acid if the attack has been brought on by alcoholic excess.

**Diagnosis.**—When the attack is of short duration and when fever is absent, there can be no difficulty in diagnosis. The separation of this affection in its more severe forms from typhoid fever, especially abortive typhoid, usually presents the only difficulty. But the absence of preceding epistaxis, of prodromal symptoms of typhoid, and the characteristic rise of temperature; of the enlarged spleen; and, later, of the typical spots; the characteristic diarrhœa and appearance of the stools, and the absence of the Widal reaction (a point of not extreme value, since it must be determined early in the disease) severally or jointly enable a separation to be made. Herpes labialis is against typhoid fever. Certain cases of acute gastritis in which the various dietetic errors before mentioned may seem to be excluded have onset in a man-

ner to suggest an acute infection. The writer has seen several instances. With severe headache and delirium at the onset—rare, though, in any stage of the disease—meningitis is easily thought of, and is at first difficult to exclude.

**Etiology.**—As remarked elsewhere by the writer, this affection is dependent upon somewhat varied etiological factors. Among these are: a too-free indulgence in the pleasures of the table; the ingestion of food or drink of irritating quality or of excessive quantity. The former includes very hot, cold, or indigestible food; spices, undiluted spirituous beverages, or the too-free indulgence in those partly diluted, and certain drugs; all of these originate acute gastritis through their local irritant action on the mucous membrane. Excessive indulgence in alcohol is a very common cause of acute gastritis.

The gastritis may be of an infectious origin due to the action of micro-organisms or their toxins. In some of the recent epidemics of grippe the writer has encountered cases in which the stomach alone bore the brunt.

**Pathology.**—In simple acute gastritis there occurs redness and swelling of the mucosa and of the submucosa, and in the more severe forms small hæmorrhages or even superficial erosions may be noted. There is much diminution in the secretion of hydrochloric acid and in the pepsin and labferments, and mucus in considerable quantity appears as the result of mucoid degeneration of the columnar epithelial cells. Histologically there is noted a granular swelling of the glandular epithelium of the peptic- and acid-secreting cells and an infiltration of leucocytes into the surrounding intertubular tissue. The functions of the stomach—the secretory, the motor, and the absorptive—are all affected.

**Treatment.**—The chief therapeutic indications are: removal of the exciting cause; checking the gastric irritability, and giving rest to the diseased organ. The first is met by the evacuation of the stomach-contents, which usually is spontaneous. Should emesis not occur and if occurring not be efficient and the presence of undigested food in the stomach be suspected, vomiting should be induced, as by the free ingestion of warm water containing sodium bicarbonate. Vomiting not being excited in this manner, or, after, emesis continuance of the local symptoms indicate that the stomach has not been efficiently emptied, a resort should be had to the stomach-tube or to an unirritating emetic. The stomach-tube is preferable in that by it after the removal of the stagnating ingesta, a thorough cleansing of the mucous membrane can be accomplished. Alternate hot (105° F.) and cool (65° F.) water is used, to which is added sodium bicarbonate at first and subsequently an antiseptic, such as a weak permanganate solution, boric acid, betanaphthol, or thymol. Should an emetic seem more expedient than the use of the tube, ipecac (1 to 5 grains), or, preferably, apomorphine hydrochlorate ( $\frac{1}{12}$  to  $\frac{1}{3}$  grain by the mouth or  $\frac{1}{16}$  to  $\frac{1}{4}$  hypodermically) may be administered. Subsequent to the complete evacuation of the stomach-contents a laxative, preferably calomel, is usually indicated. The observations of Beaumont on St. Martin indicate that calomel has an influence little short of specific on the mucous membrane inflamed through dietetic errors or alcoholic excess. Its influence seems to be both local, due to its sedative and antiseptic effect, and systemic through its chologogic action. Calomel is administered in a full single dose of from 2 to 5, or, in exceptional cases, 10 grains; given

dry upon the tongue or preferably in trituration with milk-sugar or sodium bicarbonate. If vomiting occurs soon after its administration the dose must be repeated. A saline laxative, such as effervescing magnesia citrate, is administered in from six to eight hours afterward, provided a full action of the bowel in the meanwhile has not been obtained.

Following evacuation of the stomach-contents, gastric irritability, should it continue, is best allayed by the total withdrawal of all food for a limited time; confining the patient to bed; the application of counter-irritants in the form of sinapisms or a small blister to the epigastrium, and the administration of a few doses at hourly or half-hourly intervals of: dilute hydrocyanic acid, 1 to 2 drops; bismuth subnitrate, 5 to 10 grains; in diluted mint-water. Or there may be used a powder containing cocaine hydrochlorate,  $\frac{1}{12}$  to  $\frac{1}{8}$  grain; codeine phosphate,  $\frac{1}{8}$  grain; cerium oxalate, 2 to 5 grains. Cerium oxalate alone, in doses of 5 grains given dry upon the tongue, at intervals of one-half to one hour, is often singularly efficient in checking vomiting after the contents of the stomach have been evacuated. Carbolic acid,  $\frac{1}{4}$  grain, in combination with a small dose of bismuth, exhibited in dilute mint-water, is useful. Strontium bromide in cases in which a nervous element exists is often of value. It or another bromide salt, in combination with chloral, may be administered by the rectum. Morphine may have to be resorted to hypodermically, if the nausea and vomiting continue despite the use of the above remedies after the stomach has been completely evacuated. The ingestion of bits of ice or of small quantities of iced carbonated water allays thirst and tends also to check the nausea and vomiting. Washing out



the stomach with hot and cold water alternated will often prove efficient.

For the control of gastric pain codeine internally, combined with dilute hydrocyanic acid, and with cocaine, should be used. Externally, turpentine stupes, or spongiopilin first immersed in hot water and then rinsed, is indicated. For further details see the treatment of gastric pain in ulcer.

The nourishment should be of the lightest character while the acute symptoms continue. If the patient is well nourished and the attack has arisen from dietetic discretion, as is usual, for a day or two almost complete abstinence from food is indicated. During this time peptonized milk or milk diluted with a carbonated alkaline water may be given in small quantities at moderately frequent intervals, or a preparation of koumyss may be tried. In other particulars the diet suggested in the treatment of gastric ulcer is applicable here.

#### **Phlegmonous, or Purulent, Gastritis.**

This rare disease may occur idiosyncratically or as a complication of another disease, such as typhoid fever, small-pox, puerperal fever, pyæmia, etc. Two forms are described: a diffuse purulent infiltration of the stomach-wall and a circumscribed, localized abscess, as a result of which last a purulent tumor of some size develops which subsequently opens into the stomach, externally, or into the peritoneal cavity.

**Symptoms.**—The symptoms are those of a septic process plus those of the local inflammation, which last may be altogether masked by the height of the systemic disturbance. There is high fever resembling in its character that of a severe septic infection. It is associated with great prostration of strength, delirium, and, if a fatal issue is imminent, coma; jaundice may occur. There is

nearly always localized epigastric pain and dry, heavily-furred tongue; vomiting, meteorism, and diarrhœa are usual. Death results in most cases in from a few days to two weeks. Recovery is unlikely unless the abscess perforates externally or into the stomach.

**Diagnosis.**—The separation of phlegmonous gastritis from perigastritis, subsequent to perforation of a latent gastric ulcer, acute pancreatitis, hepatic abscess, and acute poisoning is difficult, and most often impossible.

**Treatment.**—Little can usually be done even though the affection be presumed to be recognized. Endeavor should be made to control the vomiting and the gastric pain by the use of remedies suggested in the treatment of simple acute gastritis and in the treatment of gastric ulcer. Morphine is here more often indicated.

#### **Toxic Gastritis.**

**Symptoms.**—The symptoms succeeding the ingestion of a corrosive poison vary, of course, with the amount and variety of the poison taken. These, however, usually are: intense pain in the mouth, throat, œsophagus, and the stomach. There is profuse salivation, and urgent and uncontrollable vomiting. The vomited matter is usually blood-stained, and may contain bits of the destroyed mucous membrane. There is great thirst, and prostration and collapse may early occur.

Albumin and blood appear in the urine, and, microscopically, blood-cells, renal epithelium, and epithelial and blood-casts are apt to abound.

If the patient survives, the sloughs that have formed in the stomach are succeeded, after separation, by ulcers, which, in process of cicatrization, may lead to stricture of the œsophagus, cardia, pylorus.



rus, or to hour-glass contraction of the stomach. A generalized atrophy of the mucous membrane may result in cases in which the poison taken in a more dilute form exerts a necrotic effect upon the glandular epithelium.

**Diagnosis.**—The diagnosis is commonly readily made. The corrosive effect of the poison evident in the mouth and throat, the character of the vomit (and later its chemical examination), the characteristic symptoms evident, and perhaps the history of the ingestion of a toxic substance, all tend to render the diagnosis easy.

**Etiology.**—This disease is originated by the ingestion of substances which act by local destruction of tissue,—poisons,—such as oxalic acid, the mineral acids, caustic alkalies, arsenous acid, antimony, phosphorus, carbolic acid, ammonia, and the like.

The mucous membrane and the submucous tissue of the stomach is usually extensively destroyed by the corrosive poison; or, with such non-corroding poisons such as phosphorus and arsenic, its glandular structure is the seat of an acute degeneration.

**Treatment.**—The treatment consists in the neutralization of the irritant poison; for instance, for acids, the administration of a mixture of magnesia, lime, and water may be used; this forms with all the acids, except oxalic, soluble, harmless salts. If magnesia is not at hand a solution of sodium carbonate or bicarbonate, chalk, or soap should be administered. For neutralization of the caustic alkalies there should be employed dilute vinegar, lemon-juice, diluted acetic acid, or tartaric acid. Carbolic acid calls for soluble sulphates or calcium hydrate or the saccharate. Poisoning by phosphorus demands the use of copper sulphate or of the old, unrectified oil of

turpentine. The ingestion of arsenic calls for the hydrated iron sesquioxide or magnesium sulphate.

Mucilaginous substances and oils are administered as demulcents after neutralization and evacuation of the alkalies and mineral acids. In all cases of poisoning not due to corrosives or to the mineral acids the stomach should be emptied and thoroughly washed out by means of the soft stomach-tube.

### Chronic Gastritis.

**Synonym.**—Chronic gastric catarrh.

**Definition.**—A condition characterized by chronic disturbance of digestion originated and maintained by definite anatomical alterations in the stomach-wall.

**Varieties.**—Clinically it seems proper to distinguish four forms of chronic gastritis, all of which, finally, if unchecked, tend to terminate in hypertrophic or atrophic gastritis.

(a) Acid gastritis; (b) subacid gastritis; (c) mucous gastritis; (d) atrophic gastritis.

The occurrence of *acid gastritis*, as first described by Boas, is, curiously, still disputed; but, of its existence and frequency apart from the neurosis hyperchlorhydria, the writer sees almost daily examples. In this there occurs either a normal or frequently a marked heightening in the secretion of HCl, but, in the writer's experience, associated also with the presence of organic acids of fermentation out of proportion to that encountered in simple hyperchlorhydria. Here, as in many cases of hyperchlorhydria, there exists as a result of an hypertrophy and proliferation of the gland secreting elements, an actual increase of the oxyntic, or HCl-secreting, cells.

*Subacid gastritis* is that form in which the secretion of HCl is diminished in slight or extreme degree and there is coincident, but far less extensive, diminu-

tion in secretion of the ferments. Subacid gastritis may terminate in so-called (*d*) *atrophic gastritis*, in which, with more or less complete atrophy of the glandular elements, even traces of HCl are no longer apparent, and the ferments, though rarely disappearing entirely, are recognizable with difficulty only in their inactive or proenzyme stage. In this condition there finally occurs complete disappearance of the secreting structure, with absence, even, of traces of the proenzymes.

*Mucous gastritis* is characterized by the almost habitual appearance in the wash-water or in the vomit of a considerable quantity of mucus.

**Symptoms.** — Chronic gastritis is of very insidious onset, and is attended by a train of symptoms more or less striking and serious, depending upon the degree of its existence and the variety. These symptoms are those of disturbed digestion, such as loss of, or variable, appetite, and perhaps actual distaste for food other than that highly seasoned; bad taste; an habitual coated tongue in the morning and of its root as well through the day; at times nausea and vomiting, the last occurring especially in the chronic gastritis of alcoholics, when it is usual in the morning on arising and then consists of glairy mucus; gaseous eructations; pyrosis; "heart-burn," common in acid gastritis; fullness and heaviness in the epigastrium after meals—less usual in acid gastritis.

The vomited matter rejected by day, after food has been taken, as with the stomach-contents extracted through the tube, will show the presence or absence of HCl and the ferments according to the length of stay of food in the stomach and the variety and stage of the gastritis present, whether acid, subacid, or atrophic. Mucus is apt to be present in con-

siderable quantity, as are yeast-cells and bacteria which have made a habitat of the mucous membrane of the diseased stomach; leucocytes in abundance and erythrocytes in small amount may be recognized, especially in the wash-water of the fasting stomach. Lactic acid is unusual, save in traces derived from the food ingested, except with coincident dilatation and a high degree of stagnation. With similar dilatation and stagnation, but with presence of free HCl, *sarcinae* are encountered. These are especially noted in the lifted contents or in the vomit in the morning before food has yet been taken.

Gastric pain sometimes occurs in all forms, but is most usual in the gastritis of excessive drinkers. There is then present diffuse soreness, amounting, perhaps, to actual pain, occurring commonly soon after meals, but which may be present on the empty stomach. In amount and character the pain is occasionally of such severity as to originate a suspicion of cancer or of ulcer. The pain may be of the nature of gastralgia, paroxysmal and variable in occurrence, and may then be associated with diffuse or localized tenderness on pressure.

The bowels are apt to be more or less habitually constipated and the *fæces* malodorous.

Through the long-continued imperfect digestion the bodily nutrition suffers and loss in weight and a moderate anæmia or chloranæmia occurs. In atrophy of the gastric tubules with marked impairment of the motor power, or with preserved motility and presumed failure of pancreatic secretory activity, due to disease of that organ, anæmia is common and may assume the characteristics of the pernicious (so-called idiopathic) grade.

The urine in mild chronic gastritis shows no special characteristics. In that



in which the nutrition suffers the urine is apt to be diminished in amount, and thus of a relative high specific gravity, but actually with considerable diminution in amount of total urinary solids, notably of urea. The phosphates are increased and the acidity diminished.

The motor function of the stomach, especially in the early stages of chronic gastritis, is in some cases increased. Commonly in the later stages it is impaired more or less markedly, although the gastric capacity may not be increased, the diminished gastric peristole being due to coincident atrophy of the muscularis as a result of connective-tissue increase and to the lowered nutrition present.

Headache is common; attacks of mild or pronounced vertigo sometimes occur, and marked mental depression is usual. Actual melancholia may develop.

Although chronic gastritis may occur at any age, it is most usual toward middle life and is more common in men.

The course of chronic gastritis is variable. If encountered early and properly treated recovery is usual. Later, with marked anatomical changes in the stomach, as evinced by persistent diminution in secretory or motor activity, the prognosis is grave, although, even in extreme atony of the tubules with restored motor power and preserved pancreatic activity, the patient may, to all appearances, regain and maintain health for a long period. The writer has now had several cases of this sort under observation for a few years in which, with total secretory loss, originated by a chronic gastritis, the general health is well maintained.

**Diagnosis.** — A diagnosis of chronic gastritis not secondary to another gastric disease—such as carcinoma, dilatation, or to an obstructive disease of the liver, or the heart, of the lungs, or to disease of other organs, such as the kidneys—must

only be reached by the most searching exclusive process. Otherwise it is but symptomatic, and the treatment is practically valueless. A separation of the different varieties of gastritis, the acid, subacid, atrophic, and the mucous,—the first two of which may have associated with it the last,—the recognition of motor increase or impairment, can be readily made as a result of a sufficient number of examinations by means of the stomach-tube, and the application of the most approved clinical and laboratory methods, none of which, of actual value, are difficult to employ or to comprehend after a little experience with them. Unfortunately space is not permitted here for their detail.

In the differential diagnosis of chronic gastritis it is especially important to exclude the simple gastric neuroses and carcinoma and ulcer of the stomach. Attention to the symptomatology of these affections and patient study of the case under view will commonly enable a separation to be made. In excluding a neurosis, especially that form characterized by hyperchlorhydria or by anacidity, it is especially important to consider the preceding history and the accompanying objective and subjective symptoms; to make examinations of the stomach-contents in order to ascertain the condition of the secretory and motor functions on a number of occasions, and to repeat these at definite intervals; to recall that in these gastric neuroses there is not infrequently a total reversal of what has seemed the usual condition, marked atony being succeeded by hypermotility, and subacidity or anacidity, or hyperchlorhydria by its antithesis. The habitual presence of considerable mucus in the wash-water; of some amount of the organic acids, such as butyric or acetic; of, microscopically, leucocytes



and of bacteria, and of exfoliated epithelium, of course, favors gastritis.

Any comprehensive survey of the differential diagnosis is not permitted here. It is especially important to separate carcinoma and ulcer of the stomach from chronic gastritis. In carcinoma, more especially of the pylorus, with the accompanying stagnation and decomposition of food in the stomach, there are absence of free HCl and the presence of considerable amounts of lactic acid; vomiting is usual, the vomited matter showing indications of bright-red or, more likely, altered blood; there is more or less characteristic pain; and emaciation is more rapid than in chronic gastritis; often the presence of a tumor may be detected.

In ulcer there is localized and usually intense gastric pain and tenderness, the pain often extending through to the back. Gastric hæmorrhage, causing, although not always, hæmatemesis and the presence of blood in the stools, is more or less usual, although not invariable as concerns detection.

**Etiology.**—Chronic gastritis may be either primary or secondary to a pre-existing disease of the stomach, such as carcinoma, dilatation, simple atony, ulcer, or to disease of the teeth, of the mouth, of the throat, or as a result of chronic venous engorgement of the stomach dependent upon obstructive disease of the liver, the heart, or the lungs; or to certain constitutional states, such as the diseases of the blood, tuberculosis, diabetes, and to chronic nephritis.

The usual causes of primary gastritis are long-continued dietetic indiscretions; eating food improper in quality or quantity; meals at irregular or at too short intervals; habitual overeating, especially when fatigued; drinking large quantities of fluids with the meals, especially if iced or at a very high temperature;

imperfect mastication and insalivation of food through carelessness or through absence of teeth (this last is a common and often overlooked cause). The abuse of alcohol is a very common cause of gastritis.

**Pathology.**—The essential pathological process in chronic gastritis is a parenchymatous and interstitial inflammation of the secretory glandular structure and finally of the deeper layers of the gastric wall, especially in the pyloric region, which inflammatory process leads to interference with the various functions of the stomach, and to degeneration, wasting, or hypertrophy of that organ. Anatomically, two main forms of chronic gastritis are described: the hypertrophic and the atrophic. The former is largely the result of considerable connective-tissue increase, tending to give rise to much thickening of the stomach-wall, to mammillation of the mucosa and partial or complete destruction of the glandular elements. The atrophic form is that in which atrophy of the mucous membrane and of the muscularis, with coincident atrophy of the glandular elements, leads to thinning of the gastric wall and subsequently to either diminution in the size of the stomach or to its dilatation.

**Treatment.**—Effort should be first directed to ascertain if the gastritis is secondary to disease of another organ, such, for instance, as to obstructive disease of the heart, lungs, or of the liver. Ailments thus originating chronic gastritis must receive careful attention before the local gastric condition can be improved; otherwise remedial measures directed solely to the stomach will be inoperable. Drugs, such as *strophanthus*, *digitalis*, and *strychnine* for the valvular disease or the emphysema, free purgation to unload the portal circle, are frequently necessary in gastritis due to heart disease

as from that arising from disease of the liver. The existence of wasting disease and all sources of malnutrition,—such as tuberculosis pulmonum, chronic malaria, nephritis,—which predispose to chronic gastritis, must be inquired into.

If not directly or indirectly secondary to disease in another organ, the condition of the mouth should be ascertained; an examination as to carious teeth, or absence of molars (both not infrequently and usually unsuspected causes of gastric disturbances), as to the patient's dietetic and bibulous habits; these and similar underlying conditions, such as any habit of the patient prejudicial to health, must be thought of in order to obtain the best results from treatment. Systematic exercise in the fresh air, regularity in eating, with sufficient intervals between meals; thorough mastication and salivation of food; attention to the condition of the bowels and of the skin: in short, all that depends to general hygiene demands as much attention as the medicinal treatment itself.

In all cases of gastritis in which the functions of the stomach are seriously affected, especially with the existence of subacidity and the accumulation of a considerable amount of mucus and a tendency to marked stagnation of the ingesta, lavage is of the utmost utility, not only as a cleanser of the mucous membrane, but properly employed as a stimulant to the secretory and motor functions. The tube and the accompanying apparatus such as is made according to the writer's direction, by Tiemann, of New York, should be employed in order to obtain the douche effect so important in the treatment of atony and of subacidity. The tube should be used once daily at first, preferably on rising in the morning, a half hour or more before breakfast; if dur-

ing the day, at the time but little of the preceding meal remains in the stomach. The hot water is preferably medicated with sodium bicarbonate and chloride in the proportion of 2 teaspoonfuls of each to the funnelful (750 cubic centimetres); but with the existence of large amounts of mucus a larger quantity of soda is essential. Hot (105°) and cool (60°) water are alternately employed. The fluid is passed into the stomach with the intra-gastric end just engaging the cardia (approximately seventeen inches), and removed with it further introduced to the most dependent part of the stomach, the distance varying in different individuals, but, approximately in the undilated and unprolapsed stomach, twenty-one inches. The tube is again withdrawn to the former mentioned distance on the introduction of each funnelful, and again re-passed for its removal. The hard rubber funnel employed has a capacity of about 750 cubic centimetres. This or a less amount is entered at one time. The writer employed a weak solution of quassia or calumba in the cool water in cases of subacidity and when little mucus exists, with sodium bicarbonate contained in but the first funnelful of water; or sodium bicarbonate is dispensed with and hydrochloric acid in one-half or less decinormal strength is added to the bitter infusion. This line of treatment almost invariably exerts a marked symptomatic improvement. If the stomach is very foul, as in carcinoma and rarely in simple chronic gastritis, antiseptics such as saturated solution of betanaphthol, or weak borax, or sodium sulphite or permanganate solution are employed after the first washing with sodium bicarbonate. From 3 to 6 funnelfuls are required to be separately entered and removed with each lavage. The process must not be prolonged if it is debili-



tating to the patient. Silver-nitrate solution, employed in amount and procedure such as the writer directs in the treatment of ulcer, and alumnol are most useful in chronic gastritis, especially in the hyperacid and in the mucous varieties. If for any reason lavage seems impracticable, natural or artificial Carlsbad salts (sodium bicarbonate, 36; sodium chloride, 18; sodium sulphate, 42; potassium sulphate, 3.25; the sodium sulphate is added only if a mild laxative action is desired) may be employed, taken in hot solution; or, in mild cases in which a saline water seems indicated as a secretory stimulant, German Kissengen (Rakoczy) or Wiesbaden (Kochbrunner) may be used, as is recommended by Boas. These waters consist essentially of a weak solution of common salt and of alkaline carbonates, especially that of sodium, and may be replaced by the addition of these salts to ordinary water, the solution preferably being ingested rather warm. The local effects of small doses of sodium bicarbonate and sodium chloride are stimulating to the secretion of HCl, and the sodium chloride, after absorption into the blood, while unquestionably contributing to the formation of the gastric acid, is also of utility, both locally and systemically, to pepsin-formation and to the transformation of inactive pepsinogen into the active enzyme.

The frequent use of saline laxative waters, especially those containing sodium chloride and bicarbonate, besides their laxative salts (preferably sodium sulphate), are of distinct service in synergizing the effects of lavage in cleansing the stomach of mucus, promoting a healthy condition of its walls, and influencing its functions generally for good, even when lavage alone promotes regular alvine evacuations through its

stimulating effect on the gastric and the intestinal peristole.

Silver nitrate, save employed as a wash on the empty clean stomach, the writer does not regard as of utility. Bismuth subnitrate and subgallate and zinc oxide are of no special service in the treatment of chronic gastritis. In the form characterized by hyperchlorhydria bismuth is of value, as it is when gastric hyperæsthesia and actual pain are prominent symptoms. It should be given on the empty stomach in doses of 5 to 30 grains, and codeine, hydrocyanic acid, cocaine, hyoscyamus, or belladonna may be combined with it, as in the treatment of the pain of ulcer. The best result from its use is following lavage. In cases of superacidity an alkali or a combination of alkalies, such as is recommended in ulcer, is called for to be administered at a period in gastric digestion when peptonization has advanced and an amount of free HCl over that required for the completion of digestion becomes evident. The dose should be based upon the degree of acidity, ascertained by examination of the stomach-contents, after not only the bread trial-meal, but one of mixed food, it being recalled that the degree of discomfort originating from the hyperacidity may, with heightened gastric sensibility, be out of proportion to the actual extent of acidity. Here even more than in simple hyperchlorhydria too full a dose of antacid must not be habitually given soon after a meal.

In most cases of subacidity there is no remedy of more service alone or in combination with a simple bitter than HCl. Its uses in chronic gastritis are many; in acting not alone as a digestant, but also in stimulating the formation of pepsin and perhaps its own secretion; in assisting in the transformation of the inactive proenzymes existing in the gland-cells



into the active ferments; and in inhibiting fermentative processes which constantly occur in this disease when stagnation of food is usual. A combination of pepsin with it is unnecessary, since, when HCl can be of any utility as a digestant, the pepsin already exists in sufficient quantity in the gastric tubules, needing only the presence of HCl to bring it into activity. The pepsin-secreting cells are so much more widely distributed in the stomach and in so much greater number that it is almost invariable in cases in which HCl is absent other than those of complete gastric atrophy that pepsin can still be readily obtained from the stomach in quantities sufficient to act as a digestant by means of the use of HCl. The question of pepsin-and-HCl administration in diseases of the stomach has been before entered into in detail in a paper by the writer (*Ther. Gaz.*, Feb. 15, '93), a reprint of which will be sent on application.

As a secretory stimulant, HCl may be given in small doses (10 to 15 minims of the dilute acid) shortly before meals, or preferably in larger post-prandial ones, that advantage may also be taken of its ability to assist digestion. The writer commonly gives  $\frac{1}{2}$  drachm to 2 drachms largely diluted with water in divided doses at intervals of ten to twenty minutes, the initial dose being taken a half-hour after meals; or the acid may be taken through a small stomach-tube in a single dose of from 1 to 2 drachms. This last is the writer's favorite mode of administering the acid in cases of neurotic subacidity accustomed to the tube. In cases in which HCl is practically not secreted through atrophy of the gastric tubules its administration can be of no utility.

The bitter tonics—such as *nux vomica* (or *strychnine*), *quassia*, *calumba*, con-

*durango*, and *gentian*—synergize the action of HCl as secretory stimulants, and are of value (although less here than in functional [nervous] subacidity and atony) in imparting tone to the weakened muscularis. Their utility is more marked when administered before than after meals.

Intragastric electricity, but especially faradism, the writer regards (in ten years' experience with it) of value in cases of subacidity and loss of gastric motor tone.

TREATMENT OF CONSTIPATION.—Apart from the use of an occasional laxative, it should be endeavored to overcome constipation by attention to the diet and by mechanical measures, such as exercise and massage. An occasional dose of calomel or of blue mass is necessary in gastric catarrh, especially in that secondary to chronic heart or to liver disease, in which engorgement of the portal viscera exist. In the last salines are of great value. In simple gastric catarrh salines, such as sodium sulphate and phosphate in moderate doses before breakfast, not continued for a long period, are of value, but are less generally required than such vegetable aperients as *cascara*, *aloes* (in the form of *aloin*), *rhubarb*, and occasionally *podophyllum*. The writer uses largely the following combination in capsule:—

R Aloin,  $\frac{1}{8}$  to  $\frac{1}{4}$  grain.

Extract of *cascara sagrada*, 1 to 2 grains.

Extract of *hyoscyamus*,  $\frac{1}{8}$  to  $\frac{1}{4}$  grain.

Extract of *nux vomica*,  $\frac{1}{4}$  grain.

Oil of *cajuput*, 1 minim.—M.

Resin of *podophyllum* ( $\frac{1}{8}$  to  $\frac{1}{4}$  grain), *euonymin* (1 to 2 grains), and *leptandrin* (1 to 2 grains) are added when it is desired to increase the biliary

secretion, other than with calomel, and favor its flow into the bowel.

But a reliable preparation of cascara alone, the dose of which can be better regulated than that of a drug in pill form, is probably the best mild laxative; although the form of laxative should be frequently varied, as the effect diminishes with constant use. The object to be obtained, of course, is regulation of the bowels, and not mere purgation. An occasional enema of olive-oil taken on retiring (4 to 8 ounces), especially if passed into the sigmoid and retained over night, is often of signal value in at least temporarily overcoming constipation.

The previous and present dietetic habits of the patient must be inquired into carefully, and rules laid down as to the future. A specially-prepared diet-list is of great value, but this must be based on a careful study of the condition of the stomach, the state of the secretory and the motor power; the extent fermentation occurs in the stomach, and the readiness with which the carbohydrates are digested. The condition of the mouth and of the teeth must also receive attention, in order that thorough mastication and insalivation necessary for proper digestion be accomplished. The diet, while of a sort to maintain bodily nutrition, must be one which will not overtax the stomach. A milk diet, unless to meet a special indication, is not advisable. Much food must not be taken at one time, and, if motility be much impaired, a point to be carefully ascertained, a sufficient interval must elapse between meals to permit the stomach to empty itself. When solid food is taken albuminoids are preferable to carbohydrates, and sweets are usually better avoided, especially in acid and in mucous gastritis.

Eggs, soft boiled (preferably coddled)

or lightly poached, their albumin becoming opaque, though semifluid; short-fibered, tender meat, free from fat; boiled mutton; or roasted, tender beef; broiled tenderloin steak thoroughly divided; or Hamburger steak may be permitted provided they are digested without discomfort, although with the assistance of HCl, or with an active preparation of papain. The use of the latter the writer favors and has for years largely employed in cases in which other effects from HCl than the digestive were not especially demanded. Papain is administered in doses of 5 grains in combination with taka-diastase when carbohydrates are also taken and their digestion in the stomach is impaired. With this, 1 to 2 grains of powdered rhubarb and  $\frac{1}{10}$  to  $\frac{1}{5}$  grain of powdered ipecac are of utility, the dose administered in the form of a wafer. Certain of the wheat breakfast-foods that are of acknowledged ease of digestion are usually permissible, eaten with the addition of salt and a little cream. Oatmeal in any form is objectionable. Home-made light bread, forty-eight hours old, is allowed. Potatoes; pease and beans in the form of *purées*, first passed through a sieve, may be allowed; as may be fresh young pease, well mashed by the fork, young carrots and asparagus, and, save in acid gastritis, rice, if well cooked, and a small part of a very mealy boiled or baked potato. Fried food is to be avoided. Fats, except butter and cream in very moderate quantity, are not permissible. Fats mechanically delay digestion by impeding penetration of the saliva and subsequently of the gastric juice, forming, as they do, an almost insoluble coating about the otherwise soluble ingesta. Fatty acids tend to develop from them in cases in which atony is present, and enhance the unhealthy condition of the mucous mem-



brane already present. Excepting salt, condiments are to be avoided. Broths or soups made of meat-extracts must be partaken of sparingly, if at all, at the time solid food is eaten, because of their decided neutralizing effect on the secretion of HCl in the stomach by virtue of their contained salts. In small quantity at the start of a meal sapid broths are useful as peptogens, and, when fortified by a raw egg (poached by contact in the cup with the boiling broth), a light meal may be so made. Tea and coffee are better avoided. If taken they must be drunk weak and without cream or sugar. Hot milk is permissible with coffee, which should be taken after rather than with the meal. If fruit acid is craved, orange-juice, especially in the morning; sweet grapes, the seeds and skin rejected, are the best. But the pulp of juicy peaches and pears, and cantaloupes, well chewed, may also be allowed. Bananas and berries are objectionable.

In cases in which atrophy of the gastric tubules is present, if motility is well preserved, the same dietary is permissible, there being administered with each meal a full dose of papain. Diastase is less essential, as, with absence of acidity, starch digestion in the stomach, provided proper mastication has preceded, is in no way interfered with. In these and in cases of gastritis in which the nutrition is much impaired through imperfect digestion, predigested foods, such as somatose and sanose, Mosquera's beef-meal and beef-jelly; the cereals, first predigested, are demanded. Whipped eggs in the shape of flip and of egg-lemonade commonly agree well, passing in liquid form into the bowel and there undergoing digestion and absorption.

Alcohol in acid and in mucous gastritis is not permissible. In the subacid and atrophic forms, a small quantity of well-

diluted whisky at meals, Rhine, Sauterne, sherry, or Madeira may be allowed.

### Gastric Ulcer.

**Synonyms.** — Simple, round, peptic, eroding, or perforating ulcer.

**Definition and Varieties.**—Gastric ulcer is characterized by a solution of continuity of a limited portion of one, or more commonly all the coats of the stomach-wall, resulting in an open sore of varying extent. In the acute form the sore has the appearances suggestive of that which would be made by a "punch" instrument. In the chronic variety, resulting from a slower process, a much greater area may be involved; so that there is a shelving tendency from the mucous and submucous coats to the muscular and peritoneal ones, the whole assuming a somewhat funnel-like appearance. The chronic form, under favorable circumstances, tends toward cicatrization. The acute shows a less benign inclination. Deformities of the stomach-wall, such as hour-glass contraction, should the ulcer occupy the body, or pyloric obstruction, when the ulcer is in the vicinity of the pylorus, are not uncommon results of cicatrization of chronic ulcer. In both the chronic and the acute form a tendency to hæmorrhage and perforation of the stomach-wall exists. Duodenal ulcer is closely related in character to gastric ulcer. Erosions of the stomach, which are miniature ulcers of the mucosa, wholly differ from peptic ulcer, in symptoms, character, and course. What is known as carcinomatous ulcer is usually carcinoma ingrafted upon what was primarily a simple benign ulcer; but gastric carcinoma itself frequently ulcerates. Single or multiple gastric ulcers, not presenting the usual aspects of peptic



ulcer, may occur as the result of tubercular and syphilitic infection. Neither is common, and the diagnosis in life is difficult.

**Symptoms.**—A typical case of gastric ulcer presents very distinctive symptoms: these are localized, peculiar pain; vomiting; gastric hæmorrhage, showing itself as hæmatemesis, or less often by the blood appearing only in the stools. There are also other digestive disturbances, such as those attending the frequently existing hyperchlorhydria. Latent ulcer is really rare; most so-called latent cases are those in which either slovenliness in examination or ignorance on the part of the attendant causes him to slip in diagnosis, or they are cases in which there was failure on the part of the patient to consult a physician for symptoms, which, though slight, would have been obvious enough.

*Pain* is seldom, if ever, absent during the course of gastric ulcer, although it is not invariably of that character seen in typical cases. Pain may be caused by the influence of the eroding process on the sensory-nerve filaments or by irritation of the sore by food and drink, and by the corrosive action of the secreted HCl. Pain may be constantly present or may be intermittent, fixed, or paroxysmal, but is commonly both; it is most intense immediately or soon after the ingestion of food or drink, and is aggravated if chemical, thermal, or mechanical irritants are contained therein. Exceptionally the pain may not be aggravated for an hour or two after ingestion of food. When this is the case, the suspicion should be entertained of ulcer situated rather in the duodenum than in the stomach. Posture often has a marked influence on the time of appearance and the duration and severity of pain. The pain is usually both local-

ized and lancinating. The localized pain is apt to be present in a limited, small area, in both the epigastric and the dorsal region. The epigastric site of pain is often very local, and is situated at a point immediately below or not much more than an inch or so below the tip of the ensiform process. Here, exquisite tenderness is apt to be present to even light pressure, and deeper pressure, however gently applied, cannot be borne. The dorsal fixed pain and tenderness is commonly placed to the left of the eleventh and twelfth dorsal or the first lumbar vertebra, and is limited to an area not larger than that occupied by the epigastric pain. From these two sites the pain lancinates with paroxysmal exacerbations; these lancinating pains may even simulate angina pectoris.

Vomiting, though very common in ulcer, does not occur with such invariability as the before-discussed sign. Vomiting is usual in cases of ulcer, and is seldom entirely absent throughout the course of the disease. It is commonly brought about by the irritating action of the ingesta and the superacid HCl secretion on the ulcer itself, and on the hypersensitive stomach, and by the aggravation and pain so produced. Vomiting may occur immediately after the ingestion of food or drink, but, as a rule, it is less usual until after the lapse of from one-half to two hours. The character of the vomit in a case of suspected ulcer should be ascertained, and the presence or absence of blood looked for macroscopically, microscopically, and chemically, and, if the stomach-tube cannot be employed for such examinations, the total acidity and the percentage of free HCl should be determined.

*Hæmorrhage* occurs in about 50 per cent. of all cases of gastric ulcer. When profuse or noted with some frequency,

even in small amounts, it furnishes the strongest possible evidence of ulcer. If vomiting is not a constant symptom, small hæmorrhages, however, frequently repeated, may alone manifest themselves by examination of the stools. Physical exertion and the digestive act both favor the development of gastric hæmorrhage, as does emotional excitement. It also seems to be more usual at the menstrual period. The stomach-tube must be employed with discriminating caution in ulcer in which a tendency to hæmorrhage exists. One not skilled in its use should avoid its application. The fæces should be carefully and systematically inspected, and examined microscopically and chemically, if other indications of gastric hæmorrhage are not evident. It should be remembered that with the administration of a salt of bismuth or of iron the fæces are of a dark color. The occurrence of a profuse hæmorrhage causes the characteristic signs of shock; these may exist without the blood being vomited.

Chlorosis, or more advanced chloranæmia, often precedes the development of gastric ulcer. The morbid condition of the blood becomes naturally much accentuated by virtue of the lessened intake of food, the vomiting, pain, and by the occurrence of hæmorrhages. The blood-changes in a long-standing case are those of a secondary anæmia.

Other symptoms of gastric ulcer: The percentage of HCl in the gastric juice is usually increased, at least in the earlier stages, and this augmentation in many cases has long preceded the advent of ulcer. Diminution occurring in the course of the disease is usually the result of an ingrafted gastritis. Rarely in gastric ulcer total absence of the secretory function is observed.

The appetite is commonly well pre-

served, save in long-standing cases, when cachexia is present.

Gastric and intestinal flatulence are not uncommon, due to a nervous influence, or perhaps to imperfect starch digestion, with neutralization of the pancreatic secretion, and destruction of its ferments, through the action of the superacid gastric juice.

Pyrosis, or mere heart-burn, is usual.

There is nothing peculiar in the condition of the bowels. If little food is taken and vomiting is usual, constipation is the rule.

In cases with hyperchlorhydria the urine shows changes incident to that state: a tendency to low acidity or to persistent alkalinity.

Fever is absent unless as a result of a complication.

#### **Prognosis, Duration, Complications, and Consequences of Gastric Ulcer.—**

Gastric ulcer is a disease which, when encountered early, is very amenable to treatment. The prognosis, however, under any circumstance, must be guarded: the possibility of erosion of a large vessel, of perforation, of such a consequence as cicatricial stenosis of the pylorus, the frequency of relapse, should all render one cautious in hazarding an opinion as to ultimate recovery. It may be said, however, that with the intelligent co-operation of the patient a majority of the cases may be cured and relapses prevented if coming under observation at a not too late stage in the disease.

The duration of gastric ulcer is a very varied one. In cases not under favorable treatment ten years and more have been recorded.

**Diagnosis.**—This is not a matter of difficulty in typical cases. The characteristic localized pain, intensified by pressure, with the presence of emaciation, and with at least a moderate chlora-



næmia, render the diagnosis probable, even when vomiting is absent and hæmorrhage not evident. The occurrence of hæmatemesis, with the characteristic pain, can leave little doubt if carcinoma can be excluded.

To one acquainted with manipulations of the stomach-tube and the methods of ascertaining by its aid the conditions of the gastric functions, the separation of carcinoma from simple ulcer is, as a rule, easy, taking into account other important differences usually manifest. The early absence of free HCl from the gastric secretion in cancer, with diminution in the ferments, and the presence of the organic acids, chiefly lactic when the growth occupies the pylorus; the impairment, also, of the motor function, the character of the blood that is vomited, and perhaps the presence of tumor, all tend to render the separation simple. The age; family history, the comparatively early appearance of cachexia and of marked wasting in the presence of a lack of history of gastric disorder of long standing are also points of some value in differential diagnosis. The cancerous degeneration of chronic ulcer is far more difficult to recognize than is simple carcinoma, and often the recognition for a long time can be but conjectural, based on the ephemeral improvement of symptoms under treatment that experience has shown is usually remarkably successful in the cure of ulcer.

The occurrence of lancinating and sharply-localized pain increased by the ingestion of food or drink, of hæmatemesis, and of vomiting tends to separate simple hyperchlorhydria and acid gastritis from ulcer.

**Etiology.**—Gastric ulcer is of more frequent occurrence than is generally supposed. In 5 per cent. of deaths from all causes cicatrization of an old ulcer or

an open ulcer is encountered. The ratio of cicatrix to open ulcer is about three to one. Gastric ulcer is more common in northern than in southern latitudes and is apparently less frequent in America than in Europe. Some parts of Europe seem to be exempt. The etiology of most cases of gastric ulcer is still involved in obscurity. Usually more than one causative factor is operable. Some of these are: disturbances in the vascular supply of the stomach, injury to the stomach-wall, deterioration in the general health, diminished alkalinity of the blood, and long pre-existing hyperchlorhydria (this, chlorosis, and trauma are, united, presumed common factors in women); age and sex furnish a predisposition. The most usual age for its occurrence is between twenty and forty; it is rare in young children and after the sixtieth year. It is about twice as frequent in women as in men; the predisposition in the former sex being favored by the more common occurrence in them of anæmia, chlorosis, a neurotic temperament, and, it is asserted, gastroparesis; loose kidney (in the writer's opinion) may act as a predisposing cause. Occupation can have but a very indirect influence. Disease of the circulatory apparatus, involving either the heart or the blood-vessels, extensive skin burns, and infectious diseases are to be regarded as etiological factors.

**Pathology.**—The ulcer may be single or multiple, but commonly only one chronic ulcer exists. The most usual situation of the ulcer is in the pyloric region, and on the lesser curvature and toward the posterior wall. Its size is variable; the usual diameter is from one-half to one inch. The shape, which frequently varies, is oval or round, with a funicular or crater-like form. The base of the cone is at the mucous sur-



face and the truncated portion on the peritoneal coat or the surface of an adjacent organ, such as the liver, pancreas, or spleen. The edges are apt to be thickened; the bottom of irregular shape or yellowish color; smooth or rough, showing, perhaps, portions of slough on the surface. The gastric wall for a moderate distance around the ulcer, when the latter is of long standing, generally shows evidences of inflammatory change. With involvement of the peritoneal coat in the ulcer-cavity, a localized or more general inflammation of this membrane exists. In about 50 per cent. of all cases adhesive inflammation occurs to an adjacent organ or part.

An ulcer commonly terminates by cicatrization; deformity of the stomach-wall may result in consequence. In a small percentage of cases perforation of the stomach-wall may occur, or death may take place from uncontrollable hæmorrhage, due to the rupture of a large vessel. Perforation is more common with ulcer on the anterior gastric wall. Perforation, according to the situation of the ulcer, may result in purulent peritonitis, or in an abscess in neighboring organs, or in the formation of a fistula.

The acute gastric ulcer is usually of smaller size than the chronic form. Its usual appearance is that of having been gouged out of the mucous membrane. The edges are little or not at all thickened, but are apt to be deeply congested. The appearances of the ulcer are those of an inflammatory process ending in necrosis, such as is produced by acute bacterial infection. The situation of the acute gastric ulcer is usually the pyloric region.

**Complications.**—The most common are perforated peritonitis and cicatricial pyloric stenosis. Far less often seen are

development of a carcinoma at the site of the ulcer and hour-glass contraction of the stomach. Grave anæmia, simulating the progressive pernicious form, is sometimes observed in consequence of an untreated or mismanaged case.

**Treatment.**—The writer here will briefly describe only the treatment which, as a rule, he employs and has found of the greatest benefit. The prime object is to give the stomach almost absolute rest for as long a time as the exigencies of the case will permit, in order to promote more or less complete cessation of its motor and secretory functions, by making little or no demands on that organ, and thus irritation by food, by muscular and glandular activity, being reduced to a minimum, and the bodily nutrition at the same time being maintained, impediments to cicatrization are removed. Healing is also favored by a neutralization of the gastric secretion by appropriate antacids and by the employment of remedies exerting a soothing action on the ulcerated surface and upon the hypersensitive mucous membrane. The writer rarely treats a case of chronic ulcer, unless a marked tendency to hæmorrhage exists, without the stomach-tube, by which he employs remedies impracticable of use otherwise.

The patient is sent to bed for a period of from ten days to three or more weeks. For from ten days to two weeks he is to be fed solely by the bowel. All food, even milk, by the mouth is to be prohibited. Fluids, save sufficient water in which to administer the remedies ordered, are to be withheld, on account of their tendency to excite the secretory and motor functions. Thirst is assuaged by the use of pellets of ice, or by water enemas, at the time of the cleans-

ing irrigations. Water by the mouth must be especially forbidden in cases in which vomiting is a troublesome symptom.

The technique of bowel-feeding, including the form of enema preferred by the writer, is as follows: At the outset, a laxative, preferably 2 grains of calomel, may be indicated, to be given on the empty stomach, and only such nourishment as peptonized milk or peptonized milk-gruel is to be permitted by the mouth until the bowels have freely acted and again become quiet. The occurrence of hæmorrhage or of frequent vomiting contra-indicates the employment of a purgative; then a large, warm-water, cleansing enema may be used instead.

The feeding by the bowel is to be given at intervals of approximately eight hours; as at 7 A.M., 3 and 11 P.M. Some variations may be required. One hour before the afternoon and evening feeding the sigmoid flexure is to be irrigated by a pint or more of plain warm water or warm salt water. This the patient is encouraged to void after a few minutes. About three-quarters of an hour later the nutritive enema is introduced. The patient assumes the left side with the knees flexed, the pelvis being elevated by the aid of a pillow. The enema is administered preferably through a moderately firm rubber rectal tube, to which is attached a stretch of rubber tubing about five feet in length at the extremity of which is a glass funnel. The rectal tube should have a closed end and a large velvet-edged lateral eye. After warming and oiling, it is carefully inserted as high into the bowel as possible—it should at least reach the promontory of the sacrum. If the tube can be gently passed to the extent of twelve or even eighteen or

twenty inches, it renders the operation much more likely to be successful.

COMPOSITION OF THE NUTRITIVE ENEMA.—The writer commonly employs the following: A heaping teaspoonful of somatose is dissolved in as little water as possible. One large or two small eggs are now thoroughly whipped with this and then incorporated with either 4 ounces of peptonized milk-gruel or with two heaping tablespoonfuls of Mellin's food, prepared *secundum artem*. Instead of Mellin's food or the peptonized milk-gruel, 4 ounces of moderately-thick, unpeptonized gruel made of the flour of barley, wheat, or oats, and run through a fine sieve, may be used. The whole enema, when of this composition, must not exceed 8 ounces, and should preferably be less. Papain for the digestion of the egg and taka-diastase for that of the unpeptonized gruel may be added with advantage. Two to 4 teaspoonfuls of Mosquera's fluid beef-jelly further increases the efficiency of the enema, used after bowel-feeding is found to be well borne. Apart from its extreme nutritive value, the salts contained in it are of use in aiding the absorption of the emulsified eggs and in producing an antiperistaltic movement in the bowel. Without the use of the beef-jelly, a mere pinch of salt may be added to the enema. Too large a quantity will retard absorption and irritate the bowel. The enema is better tolerated in the colon than in the rectum and absorption is there more rapid. It is important also to recall that the veins draining the colon reach the liver directly. Albuminoids passing primarily to the liver are so altered that they are more easily retained in the circulation.

The enema being well borne, iron in the form of an albuminate (the writer



prefers Drees's preparation) is added in doses of  $\frac{1}{2}$  to 1 ounce.

The enema must be introduced at a temperature slightly above that of the body. If the anal orifice is unduly sensitive to the passage of the rectal tube, it is well to employ, shortly before each enema, a suppository containing 3 grains of iodoform. To this may be also added for a time or two: cocaine hydrochlorate,  $\frac{1}{4}$  to  $\frac{1}{3}$  grain; codeine phosphate,  $\frac{1}{2}$  to 1 grain; extract of hyoscyamus,  $\frac{1}{2}$  grain.

**Local Treatment of the Ulcer.**—In those in whom the stomach-tube can be employed with a fair degree of safety, and this includes the majority of cases, the following local measures, briefly cited, are used: Silver has been employed by the writer in the past ten years with the most gratifying results in cases of not only ulcer, but in those of simple hyperchlorhydria and in cases of chronic gastritis. In the treatment of ulcer he has so used bismuth for a longer time, and alumol for the past six years. The employment of alumol in cases of superacidity and in gastric ulcer is original with him.

With the patient recumbent, and a decubitus to the right, the stomach first being cleaned with pure water, 500 cubic centimetres of a solution of silver nitrate of a strength of 1 to 1000 are passed into the stomach; the tube just engages the cardiac orifice. After two to three minutes the silver solution is withdrawn, the tube first being farther introduced so that the intragastric extremity reaches the lowest part of the stomach, the position of which must first have been ascertained. Immediately after the introduction of the solution the patient is made to assume such positions as will tend to bring the solution into contact with the presumed affected part of the

stomach. After the withdrawal of the silver solution the stomach is immediately washed with cool or warm water until the washings show no coloration of silver chloride; commonly three funnelsful of water are sufficient. Finally a teaspoonful of bismuth in 3 to 4 ounces of water is passed into the stomach. The patient now, as when the silver wash was used, lies in such a position that the bismuth will come into contact with the presumed affected part of the stomach. If no nausea exists during the presence of the silver in the stomach, the solution may be retained upward of three minutes, especially if a bandage is placed about the abdomen at the level of the umbilicus. The silver application is made every third day for two weeks and then at a longer interval. Daily, when the silver is not used, 500 cubic centimetres of a 1 to 500 solution of alumol and 1 heaping teaspoonful of bismuth subnitrate is introduced. At the end of three minutes the solution is syphoned out without the introduction of more water, so that the bismuth deposited upon the stomach-walls be not disturbed. Nausea does not usually occur from the alumol. It is without toxic effect.

In cases of great debility and tendency toward hæmorrhage such local treatment must be omitted. Instead, three times daily, a small teaspoonful of bismuth in 3 to 4 ounces of water is to be given by the mouth, the patient then assuming for a few moments the posture cited.

Local treatment with silver and alumol must be continued from one to three months in a case of long-standing ulcer.

During the early period of the treatment, while the patient is abed, hot or cold compresses to the epigastrium are beneficial, but hot compresses are never to be used when there has been recent hæmorrhage. The Preissnitz applica-



tion is often of great service in relieving local symptoms. The writer employs it in most cases of ulcer.

The symptomatic use of antacids in ulcer is of distinct service. In the writer's experience, the following combination is the best: Sodium bicarbonate, calcium carbonate, magnesia usta, of each, 1 ounce; oil of anise or oil of peppermint, 15 to 20 minims. This is dispensed in a wide mouth bottle, from which  $\frac{1}{4}$  of a small teaspoonful to  $\frac{1}{2}$  or more is taken, mixed with water, as occasion requires. When there is a tendency to constipation or to unpleasant sensations in the stomach from the evolved gas, calcined magnesia or milk of magnesia is preferable to sodium or calcium carbonate. When diarrhœa exists, prepared chalk is to be preferred.

**TREATMENT OF CERTAIN SPECIAL SYMPTOMS.**—Vomiting, however obstinate previously, usually ceases within a few days after instituting bowel-feeding, when nothing is allowed by the mouth. If hot or cold applications are resultless, a small blister, one and a half inches square, is applied to the epigastrium. If mouth-feeding must be continued, only the smallest quantity of peptonized milk-gruel, expressed meat-juice, or koumyss, or some such light food, should be allowed. No medicine can be expected to invariably control vomiting in ulcer. (See the treatment of vomiting [ACUTE GASTRIC CATARRH].) Morphine hypodermically may be required, other remedies failing. Strontium or sodium bromide by the rectum is often of signal service in controlling the vomiting (40 grains in 3 ounces of water).

*Treatment of Gastric Hæmorrhage Occurring in Ulcer.*—Absolute physical and mental rest is enjoined. Nourishment must be solely by the bowel. Cold applications are applied to the epigastrium.

Morphine is administered hypodermically in a full dose. Ergot is of no utility in bleeding from erosion of an artery. It had better not be employed. Hydrastine hydrochlorate is worthy of trial given hypodermically at intervals of two to three hours ( $\frac{1}{4}$  to  $\frac{1}{2}$  grain). Fluids taken by the mouth should be cold. Pellets of ice may be swallowed to allay thirst and a light-weight ice-bag applied to the epigastrium. The extremities must be kept warm. The foot of the bed is to be elevated if necessary and the extremities bandaged. Hypodermoclysis may be required. If so, sterilized, normal salt solution may be employed or preferably the solution of tribasic calcium phosphate and potassium chloride. The colon may be flooded with hot salt solution. Instead of hypodermoclysis, the solution may be passed directly into a vein. Strychnine, atropine, and perhaps also digitalin, may be required hypodermically to sustain the flagging heart. Hypodermic injection of camphor is also of service in this direction.

There is no question as to the immense benefit to be obtained by complete rest abed and bowel-feeding in ulcer, even though local treatment is impracticable, and even the use of bismuth by the mouth by reason of great gastric irritability or hæmorrhage, cannot be employed. With anæmia controlled by the addition of iron to the nutritive enema and symptomatic conditions otherwise met, great improvement may be expected at the end of a week or two, when it is thought desirable to rebegin cautiously mouth-feeding.

*Mouth-feeding Subsequent to that by the Bowel.*—It is not to be begun for a week after vomiting and localized pain have disappeared. The most extreme caution should be enjoined as to this to

obtain the best results. Several weeks should elapse before other than the simplest food is administered.

As to the use of milk in gastric ulcer a word must here be said: Milk given with the idea of maintaining the stomach in a state of rest is a fallacy. Only in the very rare cases in which there is absence of the secretory function would milk pass as a bland and unirritating liquid into the duodenum, to be digested in the bowel; but with preserved or heightened secretory function milk must act somewhat as an irritant. In hyperchlorhydria there is always a large amount of the milk-curdling ferment in the gastric juice, and the consequence is that firm coagula promptly result, which must be irritating to the ulcer and stimulating to the motor function as other solid food. Milk is scarcely rendered more digestible by the admixture of an antacid to the milk for reasons I have detailed at length in another publication. Briefly, it should be said that the curdling of the milk is thus rather enhanced (in cases of hyperchlorhydria) and its subsequent digestion interfered with. If milk is used at all in gastric ulcer it should be first pancreatized. It is thus so changed that formation of more than traces of curd is impossible, and it is in condition to pass at once predigested into the bowel for rapid absorption there to occur. Antacids may then be freely and harmlessly given to neutralize the HCl of the gastric secretion, as the latter is not required for digestion of the milk-curd. Then little or no demand will be made on the secretory function, and the motor function will also be practically untaxed. The great objection to peptonized milk is its taste. This is partially obviated by not prolonging the period of peptonization beyond the faintly bitter stage and then

raising the temperature of the milk to a point sufficient to destroy the contained ferment. The milk should not be boiled. Better than peptonized milk is peptonized milk-gruel. The writer almost habitually employs a diet of peptonized milk-gruel in all cases of ulcer in the early part of the treatment, when feeding by the bowel is not practiced. He commonly also uses it as the first food for a number of days on the cessation of bowel-feeding, giving antacids systematically when there is hyperchlorhydria. But small quantities are allowed at first. It is well to start with a tablespoonful of peptonized milk-gruel every half-hour until 3 to 6 tablespoonfuls are taken. Later give 1 ounce every hour for three or four feedings, then 2 ounces every two hours for two or four feedings, and then 3 ounces every two hours. Increase this on the third day to 4 ounces every two hours, and this gradually increase to 6 ounces in the same time. Somatose is now combined with the milk-gruel, at first in  $\frac{1}{2}$ -teaspoonful doses until on the third or fourth day after starting it a heaping teaspoonful is taken at every alternate feeding. On instituting mouth-feeding the bowel-feeding is not discontinued abruptly. At first the midday feeding is omitted; in two or three days either the morning or evening feeding is dropped; and, finally, in a day or so, the stomach continuing tolerant, bowel-feeding is stopped. The solution of albuminate of iron mentioned is given alternately with the somatose, and after a time in a small dose with each mouth-feeding. The initial dose of the iron solution is 20 drops, increased by 5 to 10 drops, until a large teaspoonful is reached, and this at the end of a week is increased to 2 teaspoonfuls four times daily, and this later to a tablespoonful.

At the end of two weeks after discon-



tinuance of bowel-feeding or three to five weeks when this has not been practiced, unsalted broth of mutton, or chicken, thickened with farina, or thoroughly cooked barley or rice, and subsequently strained, should be given. Alternately with this a beaten white of egg is added, somatose being still continued. Somewhat later gelatin and *purées* of young pease, beans, asparagus, and potato are allowed, as is either the pulp of scraped, lightly-broiled tenderloin steak, or the pulp of raw steak; the last then formed into cakes, quickly cooked on a very hot griddle. The white of a coddled egg may now also be taken, eaten with the addition of a few bread-crumbs, a little butter, and a pinch of salt. This agreeing, on another day two whites may be eaten; and, finally, gastric symptoms being practically absent, the whole egg may be taken.

Overtaxing the stomach must be guarded against. The bodily nutrition must be raised and held so that complete and permanent healing of the ulcer occurs. On the slightest appearance of renewed symptoms a recurrence to the simplest kind of food must be had or even bowel-feeding again instituted. Gruels of wheat, barley, or oats, the meal finely ground, not salted in cooking, to which milk is added afterward, may be tried in small quantities to replace the peptonized gruel at the end of ten days. A small quantity of an active diastasic preparation had better then be coincidentally taken.

Two weeks represents a reasonable time to allow for the healing process and a fair average limit of toleration of exclusive rectal feeding. This period has been prolonged in two cases to five weeks, and has been shortened in others to meet the seeming demands of the special case. In a few cases rectal feeding has clearly provoked stomach unrest and vomiting. In some others the

period of stomach abstinence has been shortened on account of the refusal of the bowel to retain or absorb in spite of varied coaxings. If discomfort persists or hunger is importunate, small doses— $\frac{1}{32}$  to  $\frac{1}{16}$  grain—of morphine may be given once or oftener during the day.

Ordinarily a large cleansing enema is given daily and nutrient enemata every six hours. In some cases as much as a pint of nourishment can be introduced and absorbed every six hours. For thirst sometimes small quantities of water are allowed by the mouth. In other cases water may be introduced into the rectum or under the skin.

One important suggestion appears to result from the analysis of personal cases. Of 85 cases, reports to date were obtained in 52. Of 63 cases treated by rectal feeding, the end result is known in 37. Of these 37, 18 were fed exclusively by the rectum less than ten days, and in 7 there has been a recurrence of severe symptoms. Of the 19 cases fed exclusively by the rectum for more than ten days, there has been recurrence in only 1. As far as present figures go, they are strongly in favor of prolonged stomach rest. Shattuck (Jour. Amer. Med. Assoc., April 13, 1901).

The object of the bismuth treatment is to protect the surface of the ulcer from the food passing over it, which tends to break off the tender granulation tissue. Bismuth is also indicated in mild cases, when a change is being made to solid diet, and on the occurrence of complications during convalescence. It must always come in contact with the ulcerated surface; so it should be given on an empty stomach. The best plan is to wash out the stomach with one of the mineral waters, and then, half an hour later, 75 to 150 grains (5 to 10 grammes) of bismuth, mixed with water, may be given. The dose can be gradually reduced—*e.g.*, by mixing it with magnesia. In other cases, directly after the washing out, 150 to 300 grains (10 to 20 grammes) of bismuth may be mixed with 5 ounces (150 cubic centimetres) of water, and poured in. Changing the position of the patient is useful to distribute the bis-



muth. Fleiner (Münchener med. Wochen., No. 42, 1901).

In simple ulcer without complications the writer never advises surgical treatment. When there are complications, one of two conditions will be present: There is more or less hæmorrhage. If copious, use medical treatment only. If slight, but persistent, and medical means fail, resort to surgery. Surgical treatment is necessary in the following cases: Intestinal perforation, subphrenic abscess, pyloric stenosis; if cicatricial, perigastritis in persons whose means will not permit long and expensive medical treatment. Albert Robin ("International Clinics," twelfth series, vol. ii, 1902). (See STOMACH, SURGERY OF.)

### Dilatation of the Stomach.

**Synonym.**—Gastrectasia.

This term is somewhat unfortunately employed to indicate a distinct morbid entity. No exact standard of gastric capacity exists for height or make-up. It is held that a stomach may be capacious (megalogastria) and yet not be, strictly speaking, dilated. Yet there is a limit of capacity beyond which dilatation may be said to exist, although symptoms of gastrectasia are not very evident; in all probability they have existed, though unnoticed, and the gastric peristole is temporarily sufficient. This limit of capacity per average height the writer places as approximately 1800 cubic centimetres; and yet a stomach of less capacity may be chronically so myasthenic as to constitute dilatation for that individual. The presence of gastric dilatation is always indicative of some undue delay in the passage of food into the bowel. It is therefore characterized by atony of the stomach: *i.e.*, weakness of the gastric expulsive forces.

**Varieties.**—It is proper and more convenient to include under dilatation (1) *gastric atony* or *myasthenia*, occurring in a stomach the capacity of which is not beyond what is considered the normal, but

causing symptoms of moderate dilatation.

(2) Dilatation in which the gastric capacity is increased, little or much, not due to pyloric obstruction—*atonic dilatation*.

(3) *Mechanical dilatation*,—that due to obstruction at or beyond the site of the pyloric sphincter.

**Symptoms.**—With mild atonic dilatation, constituting merely gastric atony or myasthenia, the symptoms, briefly, are those ordinarily described as so-called atonic dyspepsia: habitually furred, flabby tongue; foetid breath; more or less anorexia; considerable thirst (in advanced cases); sensations of decided weight and oppression in the stomach after meals; constipation; mental hebetude, and disturbed sleep. Headache and attacks of vertigo are not uncommon. With these should there be, as is less common, hyperchlorhyria, there is a sensation of burning at the pit of the stomach superadded, occurring two or more hours after a meal and continuing until food is again taken. Gaseous eructations may or may not occur in cases of moderate severity.

Examination with the stomach-tube shows considerable delay in the passage of food into the bowel, although no food-remnants may be found in the fasting stomach in the morning, about 12 or 14 hours after the evening meal. In many cases of moderate dilatation usually there are only such symptoms as these, and certain of them may be absent excepting a sensation of weight and distress after meals.

The employment of ordinary percussion, auscultatory percussion, distension of the stomach with air and with water, and inspection of the transilluminated gastric area will separately or combinedly generally show, in these cases of atonic dilatation, the inferior curvature of the stomach to be lower than is normal, and

the gastric capacity to be more or less above the normal.

The above symptoms may alone be present, with vomiting quite unusual, and yet a considerable grade of atonic dilatation be present.

In such cases there is a so well preserved or newly gained (through active treatment) hypertrophy of the gastric muscle and well-developed abdominal muscles, with excellent positive abdominal pressure, as to tend to prevent a high grade of insufficiency; so that, although stagnation of food occurs, 8 to 10 hours being required for the stomach to thoroughly empty itself after a large meal, which normally should disappear in 6 to 7, it is not sufficient for vomiting to be a symptom, unless the stomach has been habitually overtaxed for some time and the stomach-tube has not been employed.

Vomiting is always a feature in dilatation from obstruction, as it is finally in advanced atonic dilatation, in which decided stagnation of food is usual; so that that eaten the day before is retained at the end of 12 to 14 hours. The striking feature about the vomiting in gastric dilatation is that it is unassociated with much nausea, tends to occur at variable intervals, and is copious in quantity. The uneasiness, weight, or distress felt after eating, having been dissipated for a short time by an evacuation of the stomach-contents, recurs and augments even to the point of actual pain as each succeeding meal is taken, until, at the end of 36 or 48 hours,—or longer or shorter, as the case may be,—the contents of the stomach are more or less completely and suddenly evacuated. If not completely evacuated, vomiting will recur for a time or two within a short period, as through the night. The amount vomited, should the dilatation be great, is apt to be copious.

If the dilatation is decided, the onward passage of food into the bowel being much impeded, the vomited matter consists of partially-digested material,—all that has been eaten for perhaps several days. If vomiting occurs at intervals of only four to five days, especially in stenotic dilatation, indications of food eaten before or immediately succeeding the preceding attack may be present, the stomach not having been completely evacuated at that time. The vomited matter may be in a state of advanced decomposition, containing coffee-ground material (altered blood); abundance of lactic and other organic acids, as in carcinoma; or, as in stenotic dilatation from cicatricial ulcer, may consist of quite-well-solved ingesta, but little ill smelling, and contain an abundance of hydrochloric acid and the ferments. The variation may be all the way from the first to the second described, depending upon the condition underlying the dilatation. Commonly, the vomited matter, allowed to sediment in an appropriate vessel, will promptly separate into three layers: an upper, a brownish, slimy scum, consisting of mucus, fungi, and elements of food of light specific gravity or yeasty material, etc.; a central, more or less colored fluid; and the lowest stratum, consisting of heavier solids in which altered food and blood (as in carcinoma) are more or less recognizable. Usually micro-organisms—such as schizomycetes, yeast-fungi, and *sarcinæ*—exist in the sediment in large number. With the absence of free HCl and the presence of lactic acid, the Oppler-Boas bacillus is apt to abound. Yeast-cells are found in the absence or in the presence of HCl. *Sarcinæ ventriculi*, the presence of which in a dilated stomach was formerly regarded as indicative of carcinoma, are now looked upon as telling in the other direction. *Sarcinæ*



seem to thrive best in stomachs in which moderate traces of free HCl exist.

*Gastric pain* is not itself a symptom of dilatation; if present it is due to a concomitant disease, such as carcinoma, or is the result of gastralgia or of pylorospasm.

*Constipation* is usual, varying in grade, dependent upon the degree of stagnation in the stomach-contents, and, in myasthenic dilatation also, upon the accompanying atony of the bowel.

The urine is diminished in amount, of relative high specific gravity and color, and there is a diminution in chlorides and markedly in urea.

The general health naturally suffers greatly in pronounced dilatation.

**Diagnosis.** — This is unattended with special difficulty, even though characteristic vomiting is not a prominent symptom. A mere inspection will often disclose the outline of the dilated stomach before it is distended with gas. Waves of peristalsis passing from right to left, active in cases of stenotic dilatation, are frequently seen if the stomach is much increased in size; these reaching the pylorus, should this be the seat of a neoplasm, will sometimes outline it. Palpation readily elicits an extensive splash-sound some hours after food or drink has been taken. This, in modified degree, is present in simple myasthenia without increased gastric capacity, although to a less extent and for a far less period. Ordinary percussion and auscultatory percussion will show the inferior curvature lower than normal, but will not enable a separation to be easily made from gastroptosis, although theoretically in gastroptosis the inferior boundary of the stomach does not further descend with the inspiratory act. The most useful mode of ascertaining dilatation, and separating it from a

stomach of normal capacity or of one dropped, is by rapid inflation with air through the stomach-tube, by means of the writer's exhaust and compression bulb attached to the exhaust-bottle; the stomach will ordinarily promptly outline itself on the abdominal wall. The writer has never had unpleasant results occur by this method of inflation, although he has employed it in hundreds of cases in the past ten years. It is important, not only for diagnostic means, but for therapeutic measures as well, that the patient be quickly habituated to the use of the tube. After this habituation is acquired, which ordinarily occurs in a day or two, the gastric capacity may be fairly well ascertained by means of the stomach being distended with water at a temperature agreeable to the patient and entered under low pressure. As much must be borne as can be without painful distension, and that removed measured. This procedure, repeated on one or two occasions and the mean taken, is of value. A measure of the capacity may be also simply made by distension with air, and connecting the stomach-tube to an immersed graduated flask containing water. Gastrodiaphany the writer has employed considerably for the past decade, but he regards it of less value as a means of diagnosis than air-inflation or water-distension. It is of little value in the separation of dilatation from a dropped stomach, unless transillumination is practiced through at least a litre of water.

The writer not infrequently sees cases of gastroptosis in which, without any indication of increase in size of the stomach, dilatation has been diagnosed by other practitioners, simply because the inferior curvature of the stomach has been found to be lower than normal.

Vomiting of the nature and character



before described is a valuable diagnostic sign of simple or of obstructive dilatation, as is the invariable presence at some period of the disease of semiliquid or liquid contents in the fasting stomach ten or more hours after food has been taken, as in the morning on rising.

The amount present in the fasting emptied stomach at a definite time after a measured amount of food and drink has been taken gauges the extent of the failure of the motor function, and easily separates an abnormally large, though sufficient, stomach (megalogastria) from an insufficient, dilated one. The method of Ewald and Sievers of ascertaining the motor power of the stomach by means of salol is of little value.

**Etiology.**—Myasthenia of the stomach and atonic dilatation are originated by some defect in the nervo-motor mechanisms of the stomach, which may be either congenital or acquired. A tendency to lack of general muscular tone, to flaccidity of muscle-fibre, and to readily-produced partial atony of the same is inherent in many, and is perpetuated by an unhygienic mode of life. Improper eating, though a constant and the chief factor, is but one of many operative in the production of slight or considerable atonic dilatation in these. A chronically more or less imperfectly acting motor function, with or without fair secretion of gastric juice, permits the stomach to be rarely, if ever, free from food but for a short period in the twenty-four hours. Long-continued tendency to stagnation of food originates fermentative processes in the stomach, whether there be abnormalities of the secretory functions or not, and mild gastritis is eventually set up. This leads to atrophy of the muscle-fibre, and, as a result, the motor insufficiency is apt to steadily increase and the stomach-walls to yield. Overeating, with im-

perfect mastication and excessive imbibition of fluids, tends to cause atonic dilatation. Dilatation is the easier produced, the lower the motor tone of the individual. Some have, habitually from youth up, flabby voluntary muscles, which even systematic, properly-regulated exercise fails to markedly toughen. These are apt to have a tongue the lateral aspects of which are habitually indented by the pressure of the teeth. In such gastric atony is common, or at least may be readily produced.

Inattention to proper habits of eating and drinking in the line of excessive indulgence leads to more or less increase in the gastric capacity and to the augmenting of symptoms of insufficiency. In many the loss of tone is shown in the tendency to either a partial or general descent of the abdominal viscera. There may be a general prolapse (splanchnoptosis) or simply dropping of the stomach (gastroptosis); this last is usually associated with nephroptosis (looseness of the attachment and descent of the kidney, usually the right), and often conjoined with partial or general prolapse of the bowel (enteroptosis). These subjects, even if there be only combined gastroptosis and nephroptosis, without displacement of the other viscera, have almost habitually gastric or gastro-intestinal atony. Very commonly in the writer's experience a certain amount of gastric dilatation becomes superadded. Ewald holds that a vertically-placed stomach, not infrequently seen in those in whom the general or partial ptosis of the viscera is a result of tight lacing, is always dilated. The writer has noted several exceptions to this, however. It has been held that obstruction exerted by pressure of a displaced right kidney on the descending portions of the duodenum will originate dilatation through a tendency

to partial obliteration of the bowel favoring gastric stagnation. Doubtless in the subject of gastric atony this is a contributing factor, when present. Displaced kidney is, however, so common in women without dilatation, though with gastropnoia, that this cannot be regarded as the common factor productive of gastric dilatation that certain writers imagine.

Marked loss of gastric motor tone may be of acute onset, so that dilatation will appear as an acute condition. Thus, atonic dilatation of the stomach has been noted to suddenly appear in the course of a protracted illness, such as typhoid fever. This form is due usually to paralytic superdistension of the stomach with gas, rarely as the result of fermentation. Habitual distension of a more or less atonic stomach with food or drink would easily lead to increase in its capacity mechanically by the weight of the contents tending to stretch the stomach-wall, and through the production of gases, the result of fermentation of the stagnating contents. Excessive beer-drinking is unquestionably a frequent cause of gastric atony and of subsequent dilatation. Dilatation may be set up in a comparatively short time by beer-drinking in this way. It is unfortunate that even among college-lads of education and presumed intelligence, and not solely among the lower classes, there is a tendency to abuse the stomach by bouts of excessive beer-drinking. The writer knows of city-bred medical students who have considered it a feat to drink in a short sitting an extraordinary amount of beer. Dilatation may easily, too, be set up by excessive water-drinking. Some decades ago a set of individuals, most of whom were uneducated, and ill-balanced mentally, following in the lead of Priessnitz, as concerns the employment of water

in disease, advocated hydrotherapy as a cure-all. These issued numerous special treatises on the subject, generally advocating, as a part of their system, two meals a day for all classes of individuals, and as much water-drinking as possible. Excessive appetite induced by long fasting and impaired nutrition, the last as the result of the deprivation of animal food, naturally led to overdistension of the stomach at a meal, producing thus, doubtless, in many atony and finally dilatation. Many of the apostles of this set advocated the drinking of an enormous quantity of water, especially on rising in the morning and on retiring at night. A mere megalogastria would not alone be thus produced; symptoms of dilatation naturally should soon be expected. Excessive water-drinking at the various spas is, no doubt, often the cause of a moderate amount of gastric dilatation. I have noted, at these, individuals drinking in the course of an hour an extraordinary number of glasses of water, fancying they were benefiting their health thereby. Undoubtedly those who attempt to live solely on milk and perform the ordinary duties of life lay a sure foundation for considerable dilatation of the stomach. I have seen instances of atonic dilatation so set up.

ETIOLOGY OF DILATATION DUE TO OBSTRUCTION FROM THE OUTLET OF THE STOMACH.—Pyloric stenosis is commonly originated either by a contracting cicatrix of a healed ulcer situated near the pylorus or by carcinomatous infiltration of the pylorus. Simple hypertrophy and hyperplasia of the pylorus unassociated with ulcer and cancer sometimes occurs, and naturally tends to produce dilatation. This, in the writer's experience, is not an uncommon cause of dilatation in certain cases of long-continued hyperchlorhydria. The writer has had



two examples of this recently under observation. In one continuous hyperacidity with hypersecretion had caused attacks of very painful and obstinate nocturnal pylorospasm, for which he sought relief. Considerable dilatation of the stomach, symptoms of which had not been evident to the patient, was then found to exist. Apparently in certain cases, and more especially in the debilitated and nervous, chronic hyperchlorhydria will lead to the production of dilatation solely through maintaining a tendency to spasm of the pylorus, evidently caused by the irritation of the superacid gastric juice. In one case observed by the writer, notwithstanding a marked hyperplastic and hypertrophied pylorus, which, operation disclosed, had greatly narrowed its calibre, a searching examination in life and finally the post-mortem showing demonstrated that no abnormal increase in the gastric capacity had occurred, although impairment of gastric motility, with stagnation of ingesta, had existed for some time. The stomach was actually symptomatically dilated, although of normal capacity.

A growth within the stomach, such as a polypus; or without, such as a carcinoma of the head of the pancreas; or obstruction by the pressure from an enlarged gall-bladder (from calculus, for instance) and the like, stenosing the pylorus or a segment of the duodenum, especially the superior horizontal portion, or obstruction in the same manner by the presence of cicatricial bands or diverticula, will originate dilatation of the stomach.

Numerous instances of congenital narrowing of the pylorus are now on record. It should be remembered that this is a cause of dilatation of the stomach in infants.

**Treatment.** — Attention to diet is of

prime importance here. Fluids and all food tend to remain unduly long in the stomach. For this reason the former must be partaken of sparingly and the latter in an easily digested and more or less concentrated form. Carbohydrates and fats, which are digested chiefly in the bowel, and which have a tendency to undergo fermentation in the stagnant stomach, are to be permitted only with discriminating caution, as must liquid elements, which furnish small nutrition in great bulk. The diet in cases of dilatation is much that already described in the treatment of chronic gastritis: tender meats, thoroughly divided before eating or made into patties; beef, mutton, or fowl, free from fat and fibrous structure. A limited amount of farinaceous substances must be allowed, as they are craved by the patient, who cannot expect to continue long without variation on a too-restricted dietary. The best farinaceous substances are those containing the least amount of starch and sugar. Macaroni; stale, white, or, preferably, light whole-wheat bread; and some of the fresh green vegetables, such as young pease, asparagus-tips, and tomatoes, may be permitted, provided symptoms of indigestion are not induced or aggravated by their use. With absence of hyperchlorhydria, tender-bodied sweet grapes, the juice of oranges, and a small quantity of stewed fresh or dried apple may be allowed. Thirst-creating food must be avoided.

The amount that may be eaten at a meal, and the proper intervals between meals, can be only gauged by the use of the stomach-tube to ascertain the condition of the gastric functions. While the amount eaten at one time must not be excessive, yet the interval between meals should be such that no considerable portion is still present in the stom-



ach when a second meal is taken. Meals succeeding each other too rapidly is the cause of most of the dyspeptic symptoms in these cases. It is the fruitful cause of carbohydrates disagreeing through the inhibiting and even lethal effect of the accumulated free HCl on the ptyalin ingested with the food or on the diastasic preparation administered.

Liquids must be sparingly partaken of, especially with the meals. Not over 6 ounces of fluid should be taken at a time. Buttermilk or one of the many preparations of koumyss, if agreeing, may be taken instead of water, if desired. Coffee and tea, especially with milk and sugar, are objectionable. Alcohol is better avoided; but, if weakness is decided, a wine of good body or a small amount of dilute spirits is allowed.

In cases in which free HCl is much diminished in amount it may be necessary to administer predigested foods, such as is mentioned in the treatment of chronic gastritis or to give with the meals a sufficient quantity of papain to aid the digestion of the proteids taken. The combination mentioned in the treatment of chronic gastritis is of value here. Or HCl may be administered with or without pepsin, but with full doses of either strychnine or the tincture of nux vomica, and also in combination with a simple bitter. Excepting strychnine or nux vomica, drugs are of little utility in dilatation except to meet symptomatic conditions. Hyperchlorhydria and hypersecretion necessitate the use of alkalies several hours after food, as detailed in the treatment of acid gastritis.

The remedy of greatest value is lavage, but more especially the stomach-douche. Under its systematic, intelligent, long-continued use, with coincident careful dieting, etc., stomachs at first regarded as hopelessly insufficient have been re-

stored to even more than a fair measure of usefulness. A tube must be employed that will not only insure removal of the stomach-contents, but will also allow the douche-effect in lavage. Alternate hot and cold water, plain or medicated, is used as cited in the treatment of chronic gastritis, the tube so employed that the water is projected from a height of three to five feet above the patient's head, the intragastric extremity just engaging the cardia. For the proper use of the tube the distance not only of the cardia from the incisors must be ascertained, but also that of the most dependent part of the stomach when this viscus contains about a litre of fluid. A graduated reservoir placed at a sufficient height and with a bulb attachment to obtain the valuable effect of intermittent projection of the hot and cold water is of extreme utility. The writer's two-way tube or that of Gross, of New York, employed with such a reservoir, or connected with graduated flasks manipulated by an air-pump, is of great use in douching the stomach in cases of dilatation and in chronic mucous and subacid gastritis. In treatment by the tube not over 800 cubic centimetres must be entered at one time, however tolerant the stomach may be, and the amount entered and that removed must be compared. The best time for the application of lavage or the douche is in the morning at least a half-hour before food is taken.

Intragastric faradism and the interrupted galvanic current are of some value in the treatment of atonic dilatation, but not of the extreme use claimed by certain so-called stomach specialists. The writer's ten years' large experience with intragastric electricity enables him to speak with some authority on the subject.

Percutaneous application of galvanism and faradism, electromassage, and mass-

age are also of utility in the way of imparting tone to the relaxed abdominal wall. For technique of these methods see the writer's article on treatment of dilatation of the stomach ("System of Practical Therapeutics," vol. ii, p. 963, *et seq.*). With pronounced bulging of the epigastrium, especially if coincident prolapse exist, a cushion pad suitably confined, constantly worn by day tends to relieve sensations of fullness and weight present.

The treatment of constipation occurring in dilatation of the stomach is on lines similar to that given in the treatment of chronic gastritis. Lavage and the stomach-douche are of the greatest value in this connection, and massage, electromassage, and percutaneous abdominal galvanism and faradism are also of use.

The surgical treatment of dilatation of the stomach, such as that of gastroplication, or gastrorrhaphy, for reducing the size of the stomach in simple atonic dilatation; and, for remedying a stenosis of a pylorus the result of a cicatrix, or of an hyperplastic sphincter, Loretta's digital divulsion; or, preferably the pyloroplastic operation of Heineke-Mikulicz; resection of the pylorus, and the operation of gastro-enterostomy are discussed in another section.

### Carcinoma of the Stomach.

**Symptoms.**—As gastric carcinoma does not frequently succeed chronic dyspepsia (chronic gastritis or a prolonged gastric neurosis) and only in a small percentage (approximately 5) follows or is ingrafted upon gastric ulcer, dyspeptic symptoms do not usually long precede the development of the disease. Commonly the patient, who has been in fair health, gradually loses vigor, and develops gastric symptoms, slight and obscure at first, but later becoming prominent and obvious.

There is gradual, but steadily increasing, debility; emaciation; anæmia, which late in the course of the disease may be of high degree; a cachectic hue of skin; anorexia; eructations; nausea and vomiting; constipation; hæmatemesis (or oftener melæna or melænæmesis), and gastric pain (not as severe as in ulcer); and later a gastric tumor may be palpable. The course may be rapid, death occurring in two to six months from the onset,—the writer recently saw such a case,—or more usually extends over a period of from one and a half to two and a half years. Coincident rather marked loss of strength and progressive emaciation is a common and usually early symptom, antedating often the appearance of distinct gastric symptoms. The anæmia, moderate at first, becomes marked as the disease progresses. It is of the secondary type, not resembling, save in a few instances, the characteristics of pernicious anæmia. The blood-count rarely falls below 50 per cent., and though poikilocytosis may be present, and, in advanced cases, nucleated red blood-corpuscles, the large corpuscles are wanting. There is usually a moderate grade of leucocytosis, and, though not distinctive of cancer of the stomach as was at first held, absence of a digestive leucocytosis, when the growth favors marked stagnation of the stomach-contents, with diminution in or absence of the secretory gastric functions. The cachexia, as the term is applied to the hue of the skin, consists of a pale-yellowish hue, which may be associated with brownish stains (the cachexia chloasma). The heart's action is usually enfeebled, due, in the later stage, to a fibroid degeneration. Edema of the feet, eyelids, and ankles is then common. Toward the termination of the disease a subnormal temperature is common; but, preceding the fatal issue, fever of an irregular



course may be present. Occasionally, in the course of the disease, fever due to a septic complication may occur. A distaste for food, and especially for animal food, is usual. Occasionally cases are encountered, as the writer has noted in several instances, in which the appetite is well preserved to the end. Nausea is apt to be a prominent symptom, before the occurrence of vomiting is usual. It is more common than in ulcer. The tongue may be coated or clean; as the disease advances, with the ingrafted and extending gastritis, the tongue becomes more or less habitually furred. Vomiting is a usual symptom, especially with carcinoma involving the cardia or the pylorus. It is infrequent at first, but, as the disease progresses, is of daily occurrence. It may occur immediately after food is taken, as in cancer of the cardia, or, in that of the pylorus, not for an hour or more after meals. The character of the vomit depends upon the seat of the disease and its stage: briefly, plus the presence of blood, it has the character of that noted in dilatation of the stomach, with absence of free HCl. The vomit is usually of offensive odor, the color depending upon the character of the food taken and whether there be bright-red or altered blood mixed. Microscopically are found food-elements, epithelium (commonly of no characteristic variety), various micro-organisms, among which is, perhaps, the *Oppler-Boas* bacillus. *Sarcinæ* are far less often encountered than in benign pyloric stenosis with preservation of secretion of HCl. Fragments of the tumor are rarely found in the vomit; less rarely minute bits of the growth are encountered in the wash-water.

Free HCl (recognizable as unbound) is not invariably, but almost constantly, absent from the stomach-contents, save

in the cases of carcinoma developing from simple ulcer, and also in the earlier stage of carcinoma in which no diffuse gastritis has resulted. An actual small secretion of HCl commonly takes place throughout the course of the disease, but it is so minute as to be unrecognizable by the commonly-employed tests. In cases with complete atrophy of the gastric tubules alone is it absolutely absent. Carcinoma is usually fatal before this condition occurs. There is coincident diminution in the amount of the ferments, pepsin and lab, secreted; but these latter do not entirely disappear, as is the case in glandular atrophy, succeeding a chronic gastritis, and in neurotic suppression of secretion.

Lactic acid commonly abounds in carcinoma stenosing the pylorus, with absence of free HCl and the presence of decided delay in the passage of food into the bowel. The greater the degree of stagnation of the ingesta, the more pronounced the lactic-acid production. To distinguish with absolute certainty lactic-acid production from that derived from the food, proceed as follows: Wash the stomach thoroughly with warm water until all traces of food have disappeared. Administer a pint of moderately-thick gruel made from fine oatmeal, with the addition only of salt. Eight to ten or more hours later (the period of removal depending upon the degree of stagnation) the patient being at rest in bed and no food or drink having been taken in the interval, the gastric contents are aspirated or expressed. The filtrate, if clear, is now directly tested. If it be colored, instead, exhaust 30 to 60 cubic centimetres with five times its volume of ether, and test the aqueous extract of the etherial residue. Five to 10 cubic centimetres of an aqueous solution of ferric chloride, so dilute as to be almost



colorless, is placed in a test-tube, and a few drops of the filtrate added. The faint-yellowish color of the iron solution assumes a deep-canary yellow in the presence of lactic acid. A less delicate and less reliable test is Uffelmann's carbolated-ferric-chloride solution (a dilute solution of ferric chloride containing a few drops of a 5-per-cent. solution of carbolic acid). The violet hue of this is also changed to a canary yellow. (For a detailed account of the various methods of examination of the stomach-contents, see a paper by the writer, *Medical News*, Feb. 18, '93, a reprint of which will be sent on application.)

With the presence of large amounts of lactic acid, pyrosis is often a common symptom.

As the case progresses, the presence in the vomit (or in the removed stomach-contents) of altered blood, rather than that of bright red, appears. The blood, because of its rather long sojourn in the stomach and mode of appearance (not as a frank hæmorrhage as is usual in ulcer), is apt to be of grumous, brownish-black or coffee-ground appearance, and will distinctly color the vomit or the contents removed by the tube. Unlike as in ulcer, large hæmorrhages are infrequent, but the vomiting, or the presence in the removed contents, of altered blood is common. Occurring also, unlike as in ulcer, the intervals between the hæmorrhages or a small series of them are slight if at all apparent.

Anorexia is usually a marked symptom. Occasionally the appetite remains remarkably good. The tongue is much like that seen in chronic gastritis, rather thickly coated, especially in the morning. The bowels are usually much constipated, especially when a high grade of pyloric stenosis and vomiting occur. The urine is more or less scanty and high colored,

and of relatively specific gravity. It shows deficiency in the chlorides. There may be an increase in the amount of nitrogenous output. Indican is increased in amount, and acetone and diacetic acid may be encountered.

A tumor is frequently met with in carcinoma involving the pylorus when the case first comes under observation. It should always be painstakingly and persistently sought for. In examination the abdomen must be relaxed and palpation made under full inspirations. Air-distension of the stomach, to bring the pylorus below the edge of the liver, may be necessary to disclose the presence of tumor. Its employment should never be omitted. A tumor of the lesser curvature, palpable in the presence of a dropped stomach, tends to disappear on air-inflation. The tumor commonly has a firm feel and is painful to palpation. Evident tumor may, of course, be absent; because of this we cannot exclude carcinoma. Simple hypertrophy of the pylorus and persistent reflex cramp simulate tumor. Such cases are on record, and the writer has seen several incidents of them. Fæces in the colon should not be allowed to mislead, the bowel being first thoroughly cleansed by repeated irrigation before a decision is reached. It should be remembered that pyloric tumors are not influenced by respiration unless adherent to the liver, and that without adhesions to adjacent parts the position of the tumor may be much lower in the abdomen than is the normal pylorus.

In carcinoma of the cardia there is increasing and persistent dysphagia and a sensation as if a foreign body were present in the region of the cardia, especially after the ingesting of food and drink. Regurgitation of solid food immediately after it is swallowed is usual.

Retching and vomiting are common, the vomited matter consisting of mucus and but little or no food, save when a diverticulum has formed into which the food passes. Emaciation and debility are more rapid than in cancer of other parts of the stomach, but marked cachexia is usually absent. Hiccough is often present associated with retching. Pain, when present, is situated behind or near the xiphoid appendix. There may be retraction of the epigastrium. An obstruction at the depth of sixteen to seventeen inches from the incisor teeth is encountered in the attempt to pass the stomach-tube or œsophageal bougie. On the extremity of the tube after removal there is apt to be blood-stained mucus, and the lateral eye of the tube is apt to contain food-elements, blood, and mucus, and even a bit of the growth.

**Diagnosis.**—The diagnosis is usually a matter of little difficulty in the presence of the various symptoms already detailed, such as nausea and vomiting; the characteristic (small and frequent and grumous in appearance) gastric hæmorrhage; the emaciation, debility, and anæmia; increasing cachexia; the presence of tumor; the absence of free HCl in the stomach-contents, with the presence of lactic-acid formation. The diseases with which carcinoma is oftenest confused are ulcer, chronic gastritis, benign stenosis with dilatation, and a profound gastric neurosis. A separation is commonly easily made except in the cases of carcinoma ingrafted on ulcer. But here the further progress of the case; the lack of persistent improvement under treatment usually invariably curable in ulcer; the presence, more or less persistently, of blood or altered blood in the removed contents or in the vomit, and the increasing cachexia and anæmia tend to indicate the existence of ingrafted carcinoma.

**Etiology.**—Carcinoma of the stomach is a common disease and of more frequent occurrence in this country than in Europe. Next to the uterus, the stomach is the most usual seat of primary cancer; secondary cancer, also, though rarely, occurs here. It is a trifle more frequent in men than in women. Seventy-five per cent. of all cases occur between the fortieth and sixtieth years; 21 per cent. between the sixtieth and seventieth years; over 13 per cent. between the thirtieth and fortieth years, and nearly 3 per cent. between the twentieth and thirtieth years. Heredity, chronic gastritis, chronic ulcer, and traumatism of the stomach are factors of varying importance in etiology.

**Pathology.**—The most commonly noted varieties in their order of frequency are: (a) cylindrical-cell cancer, or epithelioma; (b) the soft-glandular, or medullary, cancer; (c) the hard-glandular, or scirrhus, carcinoma; (d) the mucous, or colloid, carcinoma. Many gradations exist between these types. The scirrhus has the most chronic course, and the medullary the greatest tendency to ulceration, degeneration, and to give rise to metastases.

**Situation.**—Welch's statistics show that 60.8 per cent. occupied the pyloric region; 11.4 per cent. the lesser curvature; 8 per cent. the cardia; 5.2 per cent. the posterior wall; 4.7 per cent. the whole or the greater part of the stomach; 2.6 per cent. the greater curvature; 2.3 per cent. the anterior wall; 1.5 per cent. the fundus; 3.5 per cent. were multiple growths.

When in the pyloric region a tendency to girdle this orifice is early shown, causing the ensuing stenosis so commonly met with in gastric cancer; when occupying the body of the stomach the growth



is usually limited to but a portion of its circumference.

The cylindrical-celled epithelioma has a firmer consistence than the medullary, although, like the last, it has a nodular formation, and shows on its surface fungoid elevations, from which hæmorrhagic extravasations are frequent. Sections of it display an abundant stroma, in which are contained tubular spaces filled with columnar epithelium. Ulceration is common, but not nearly so frequent as in the medullary variety. The most frequent seat of the cylindrical-celled cancer is, as of the scirrhus variety, the pyloric region close to the valve.

The medullary cancer grows in soft, nodular masses, following the course of the lymphatics and involving all the coats of the stomach. It shows a tendency to early extensive ulceration. It has a scanty stroma, in which are inclosed alveoli containing irregular cylindrical and polyhedral cells. The medullary cancer has no common seat, although its predilection, like that of the other varieties, is for the pyloric region.

The scirrhus variety, as its name indicates, is of characteristic firmness, due to the abundance of stroma and the small amount of alveolar tissue. No tumor-nodules proceed from its growth, but merely dense thickening of the infiltrated stomach-wall. It affects almost exclusively the pylorus, which it stenoses, converting the latter into a rigid, tubular ring. Its surface tends to show flat ulcerations.

The colloid or alveolar cancer shows large alveoli distended with translucent colloid material. It had a tendency to widely involve all the stomach-coats, to spread to other parts, and may form colloid metastases in other organs. It shows no marked inclination toward ulceration.

Various distortions may occur in the

stomach as the result of the growth of the cancer, involving one or the other of the orifices, the body of the stomach, or through formation of adhesions to adjacent organs. There may be atrophy of the stomach when the cardia is involved; massive or, occasionally, no dilatation, with involvement of the pylorus; or a greatly thickened or contracted stomach, with affection of its body.

Metastatic cancerous growths are very common, occurring in the adjacent abdominal lymphatics (but also in the axillary, cervical, and the inguinal glands), the liver, the peritoneum, omentum, intestine, pancreas, pleura, lung, and less frequently in other organs and parts.

With extensive ulceration, which occurs especially in the medullary cancer, a tendency to perforation of the stomach-wall, as in simple ulcer, exists. Among other micro-organisms, more or less constantly found on the surface of the carcinoma, the so-called Oppler-Boas bacillus has, in the past few years, excited some attention. It is an unusually-long and non-motile organism, with one end narrow and the other thick. It is a lactic-acid producer, but is not pathognomonic of carcinoma. It occurs in carcinoma involving the pylorus, and has been found in benign pyloric stenosis, when dilatation and coincident stagnation of food is present, with absence in the secretion of free HCl.

In the course of cancer of the stomach there occurs an interstitial gastritis with granular degeneration of the gland-cells and subsequent atrophy of the mucosa; in consequence of this there is, from usually an early period in the disease, a diminution in the secretion of HCl and of the ferments, and in the latest stage of the malady HCl no longer occurs in recognizable amounts, and the ferments are present only in traces.



**Treatment.**—The treatment of cancer of the stomach is, of course, merely palliative. However early recognized, its cure is impossible. In the future, with more exact diagnostic methods, its early recognition, before debility and cachexia and the occurrence of metastasis render a radical operation futile, may permit excision of the growth to be sometimes of avail.

Life may be prolonged by the use of lavage and a suitable diet. Lavage is of the utmost utility in obviating the effects of autointoxication, in relieving stagnation occurring in the stomach-contents, and thus improving the condition of the motor function and holding somewhat in check the coincident gastritis. Under its influence intelligently carried out, symptomatic improvement is sometimes remarkable, though unfortunately nearly always short-lived. If lavage can be suitably carried out (as is outlined under the treatment of dilatation), it should never be omitted from the treatment.

The diet is practically that already given in the treatment of dilatation of the stomach, but carbohydrates and fats must be more liberally permitted. With preserved motility, far less restriction as to these substances is necessary, and, indeed, whatever is desired in the way of wholesome food, if it does not tend to create nausea and vomiting, may be allowed. If butter is well borne, it, as well as olive-oil, is permitted, because of the high caloric value of fats. Concentrated nutriment (finely-scraped beef, somatose, sanose, whipped eggs) and predigested foods are usually essential with marked involvement of the pylorus and resulting stagnation in the stomach. More license in the choice of food is permitted

when lavage is systematically employed. The use of a papain and a diastasic preparation is advisable when predigested food is not given. (See the treatment of dilatation.)

Carbonated drinks are inadvisable, although champagne is often well borne. If stimulants are constantly indicated, well-diluted whisky is the best, but a good claret, or Burgundy if it agree, may be allowed.

With the occurrence of frequent vomiting, not checked by the use of lavage, a diet for the time limited to peptonized milk-gruel, iced Mellin's food, expressed meat-juice, or koumyss, much as is recommended in the treatment of ulcer, must be employed.

For the relief of gastric pain, should codeine, hydrocyanic acid, and bismuth not be of avail, morphine, or the deodorized tincture of opium, should be unhesitatingly employed. For the relief of the impaired motility and the accompanying gastritis, besides the employment of the most essential lavage, certain stomachics, the chief of which here is condurango, are of service. Condurango has been found of such usefulness in gastric carcinoma that once claims of a specific effect were made for it. Pain and vomiting seem sometimes to be lessened by it and appetite promoted. The original formula of Friedreich's was: macerate  $\frac{1}{2}$  ounce of condurango-bark for twelve hours in 13 ounces of water; subsequently evaporate by boiling to half this quantity. Strain and administer  $\frac{1}{2}$  ounce three times a day. A fluid extract of condurango may be employed in doses of 20 minims. To the condurango the following may be added, useful in all cases attended with atony and diminished gastric secretions:—

R Dilute hydrochloric acid, 10 to 15 minims.

Dilute hydrocyanic acid, 1 to 2 minims.

Tincture of nux vomica, 3 to 10 minims.

Spirit of chloroform, 5 to 10 minims.

Tincture of orange, 20 minims.

Fermentation occurring in the stomach-contents is usually obviated by lavage with antifermentatives, such as sodium sulphite, betanaphthol, boric acid, thymol, etc., used in dilute solution. With the presence of organic acids in any amount, occasioning pyrosis and other symptoms of fermentation, antacids, such as sodium and calcium carbonate, and magnesium carbonate, or dried magnesia, may be given, combined with charcoal, betanaphthol, menthol, etc. A drop or two of oil of cajuput, or a portion of a minim of oil of peppermint or anise, may be added to each powder.

Constipation is relieved by the use of lavage, and one of the vegetable laxatives, such as cascara, rhubarb, or aloes (aloin), mentioned under chronic gastritis and under dilatation. For the anæmia, an iron preparation, preferably the albuminate or peptonate, or the saccharated carbonate (in dose of a small teaspoonful three times daily), or arsenic (the acid or the alkaline solution) may be given.

### Gastroptosis.

**Synonyms.**—Enteroptosis; nephroptosis; Glénard's disease.

In this disorder there occurs a downward displacement of the stomach and of the right kidney and perhaps one or all of the other abdominal viscera. Glénard's disease is a common affection in women, and not infrequently is encountered in spare, ill-nourished men. The causes are various: tight lacing; child-

bearing; debilitating diseases, etc. So many cases are encountered in young women who have neither laced nor borne children that other causes little understood must be operable. The disease may be symptomless, as I have noted in a number of cases, but commonly various general (neurasthenic) and local (dyspeptic) symptoms occur. The diagnosis is the recognition of the usually combined condition: gastroptosis and nephroptosis. The loose right kidney is usually easily grasped in these subjects by bimanual palpation, the patient semi-recumbent or recumbent, with head and shoulders supported by a pillow and knees semiflexed. The patient is directed to maintain a condition of relaxation of the abdominal wall and to take a full inspiration. Toward the end of the inspiratory act the kidney can usually be easily grasped and held between the two hands. The left kidney, less frequently loose, can be similarly palpated. The dropped stomach is recognized by the measures outlined in the symptoms and diagnosis of dilatation. Air-inflation and the use of the gastroduaphane tend to readily establish the diagnosis of dropped stomach.

**Treatment.**—This consists in development of the flabby abdominal muscles and conversion of the condition of negative intra-abdominal pressure into that of a positive one, in order to obtain natural support for the prolapsed organs. The intelligent use of graduated exercises, with or without apparatus, is most important in this particular. The use of a cushion-pad or bandage, if such is practicable, sometimes tends to relieve symptoms.

Attention should be directly paid to the digestive symptoms: Removal of constipation and gastric atony; regulated wholesome diet, such as will not only



agree with the stomach, but enable flesh to be gained. Intragastric and percutaneous faradism is of value.

### Functional Diseases of the Stomach and the Gastric Neuroses.

There is a large class of gastric disorders which must still be regarded as functional, and which are commonly grouped, collectively, among the gastric neuroses. Most of these affections are without present discernible minute anatomical alteration. Their existence seems to be dependent upon a strong neurotic taint, and to have had origin as a part of a general or local pronounced neurasthenic state.

Certain affections classed with the neuroses, such as hyperchlorhydria and continuous absence of the gastric secretory function (achylia gastrica), stand on the border-line, as it were, between the functional and organic diseases of the stomach. In a large number of cases of hyperchlorhydria there exists a proliferation of the acid-secreting cells, or of the gland-cells as a whole, and in a large number of cases of achylia gastrica now on record without preceding history of either a neurosis or suggestive of gastritis, the indications are that actual atrophy of the mucosa exists, probably as a result of a latent glandular gastritis. These, and especially the last named, have no place among the neuroses, although commonly considered with them.

The neuroses of the stomach are conveniently grouped into the sensory, the secretory, and the motor. The following convenient classification is practically that adopted by Boas:—

**SENSORY NEUROSES.**—Hyperæsthesia; anæsthesia; gastralgia; gastralgokenosis; bulimia, or hyperorexia; polyphagia; acoria; anorexia.

**SECRETORY NEUROSES.**—Superacidity, or hyperchlorhydria; gastrochylorrhœa

(gastrosuccorrhœa periodica and continua chronica); subacidity, or hypochylia; achylia gastrica, or inacidity.

**MOTOR NEUROSES.**—Hypermotility (peristaltic unrest of the stomach); atony, or amotility; rumination (merycism) and regurgitation; cardiospasm; incontinence of the pylorus; pylorospasm; nervous eructations; pneumatosis; nervous vomiting.

**Sensory Neuroses.**—**GASTRIC HYPER-ÆSTHESIA** is an increased irritability of the sensory gastric nerves. In presence of normal gastric secretion and motility, or these deranged in minor degree, there occur attacks lasting days or months, in which distress is experienced after all food and often after water, if taken save in the smallest quantity. Gastralgia, allied to gastric hyperæsthesia, as is cutaneous hyperæsthesia allied to actual neuralgic pain, may co-exist. This affection occurs in neurotics often without assignable cause, or it may exist as a consequence of constitutional states, such as chlorosis. Excesses in venery or alcohol predispose.

*Treatment.*—The underlying cause must be especially aimed at and the general bodily nutrition, if below par, raised. Any article of diet that seems at fault must be forbidden. Silver, alumnol, and bismuth, locally, as suggested in the treatment of ulcer, are of value. The bismuth should be employed in a smaller dose, and combined with codeine and perhaps cocaine and dilute hydrocyanic acid, as in the treatment of the pain of gastric ulcer. If gastric motility is good and hypersecretion does not exist, the silver may be administered by the mouth in solution in a dose of  $\frac{1}{8}$  grain, diluted with water, fifteen minutes before meals. Courses of strontium bromide and arsenic are of special service in the highly neurotic, as are asafœtida and



valerian. Local applications, such as a Preissnitz bandage, constantly worn by day, is most useful, as are general hydropathic measures. The rest-cure may be demanded with the local and general treatment.

The reverse condition to the above, more or less ANÆSTHESIA of the gastric mucosa, may exist as a neurosis; so that there is little appreciation of satiety after meals, or no sensations of discomfort after the ingestion of substances that ordinarily would excite gastric uneasiness, such as those of extremes of temperature, and overseasoned food. The most nauseous drug can be taken by certain of these cases without the usual effect.

**GASTRALGIA.**—In this affection attacks of severe paroxysmal epigastric pain occur which radiate over the abdomen and through into the back. Attacks occur either by day or by night, and often show a curious periodicity. In the simple variety (not dependent upon ulcer, gastrosuccorrhœa, or pylorospasm) it is either independent of food or the pain may be relieved by eating or by drinking a hot liquid. Vomiting is not usual unless the gastralgia accompanies ulcer or is associated with and caused by pylorospasm and gastrosuccorrhœa. Gastralgia may occur solely as the local manifestation of a neurosis; or as an accompaniment of gastric ulcer, cancer, or a motor or secretory neurosis, such as pylorospasm, cardiospasm, gastrosuccorrhœa; or it may have a central cause in early or advanced tabes.

*Treatment.*—The treatment of this affection is on lines laid down under the management of gastric hyperæsthesia, the paroxysm being treated similarly as are the pains occurring in ulcer: Sinapisms, or turpentine stupe externally, and morphine hypodermically (guardedly resorted to in attacks occurring frequently)

in the more severe paroxysms. In the intervals, or in mild seizures, hydrocyanic acid, cocaine, and codeine, with bismuth or with cerium oxalate, should be given on the empty stomach.

The following combination is useful in mild attacks:—

- R Oil of cajuput, 1 to 4 minims.
- Spirit of chloroform, 10 to 20 minims.
- Aromatic spirit of ammonia, 10 to 20 minims.
- Tincture of valerian, 10 to 20 minims.
- Compound spirit of lavender, to 2 drachms.—M.

This represents one dose, to be taken in water at intervals of a half-hour.

The use of silver nitrate as directed in ulcer and in hyperchlorhydria should be tried. If the last-named affection co-exists, antacids are necessary.

**GASTRALGOKENOSIS.**—This title is used by Boas to describe a condition in which sensations of most disagreeable or even painful emptiness occur one to two hours after meals and continue for from a quarter to a half-hour and are not associated with bulimia. The ingestion of food relieves the distress as in typical hyperchlorhydria. Hemmeter rightly suggests that this affection is a mingling of gastric hyperæsthesia, hypermotility, and of HCl excess.

**BULIMIA (HYPEROREXIA, OR CYNOREXIA).**—Bulimia occurs as a simple neurosis or in association with other local gastric (ulcer; HCl excess), intestinal (tape-worm), or general condition, such as hypermotility, the various psychoses, brain-tumor, etc. The affection may be periodical and of sudden onset, with short or long intervals of freedom, or exist as a chronic condition. The seizure is characterized by sudden oncoming, intense,

gnawing, distressing hunger, from which, if not immediately satisfied, there results sensations of terror or of impending danger, and curious nervous phenomena, such as prostration of strength, headache, tinnitus, cardiac palpitation, pallor, or even fainting. Small quantities of food may readily satisfy hunger and dispel these symptoms, or an enormous amount may be required. A large number of meals is often eaten in a day. Bulimia may alternate with anorexia.

**ACORIA.**—Acoria is that condition in which perhaps without primary hunger, there is absence of the sensation of satiety, although enormous quantities of food may be eaten. It is dependent upon the same causes as bulimia. There may be a transition between the two affections.

**NERVOUS ANOREXIA.**—In this neurosis both appetite and the sensation of hunger is completely and permanently absent and an absolute aversion for all food may exist. The patient becomes greatly emaciated; so that her appearance suggests a wasting disease, such as tuberculosis pulmonum.

The treatment consists in searching for and removing the underlying cause; vegetable bitters should be given, such as nux vomica or strychnine, condurango, etc. Hydrochloric acid is of service in combination with these. Orexin (basic) or the tannate, commonly recommended, is not of much value in promoting appetite in these cases. Forced feeding may be required, as may the so-called Weir Mitchell rest-cure.

**Secretory Neuroses.**—**HYPERCHLORHYDRIA (HYPERCHYLIA; SUPERACIDITY).**—Hyperchlorhydria is a condition characterized by an increase in the percentage of the secreted HCl and of the ferments in the gastric juice. It may be associated with a much-increased flow of

gastric juice, the percentage of HCl and of the ferments remaining normal. It occurs (a) as a pure neurosis without anatomical alterations in the gastric tubules; (b) as a result of a decided increase in number of the acid- and ferment- secretory cells,—a proliferation of the glandular elements and especially of the acid-secreting cells; (c) as a form of gastritis (gastritis acida). As a pure neurosis its occurrence is not constant, and periods are not infrequent in which subacidity or in acidity alternate with it. In class *b* the hyperchlorhydria is more constant. In class *c* the total acidity of the gastric filtrate, though heightened by an increased percentage of HCl, is also augmented by the presence of a fair or considerable amount of the acids of fermentation.

In hyperchlorhydria free HCl appears earlier than normal in the process of digestion and exists in an increased percentage throughout the digestive phase. The acidity of the gastric filtrate at the height of digestion of various trial meals is upward of 0.4 to 0.7 per cent., instead of the usual 0.15 to 0.2 per cent. The digestion of proteids is very active, and that of carbohydrates greatly interfered with. Hyperchlorhydria is a very common affection, forming a high percentage of the cases of the various forms of indigestion that one is called upon to treat. It is common in neurotic subjects, and its development can often be traced to nervous strain, worry, or fatigue.

*Symptoms.*—Briefly, there is more or less gastric distress, uneasiness, or diffuse pain occurring at a variable time after meals (one to three or four hours), at a period when saturation of the albuminoids and salts of the ingesta has occurred and a considerable excess of HCl over that necessary for this purpose becomes evident. There is often an accompany-



ing sensation of burning in the epigastrium (heart-burn), and pyrosis is common. These symptoms are quickly dissipated by the ingestion of food or by a full dose of antacid.

The appetite is well preserved; the bowels may be constipated, especially if intestinal indigestion is present. This last often occurs in consequence of the ill effect of the high percentage of HCl on the pancreatic secretion. Both gastric and intestinal amylolysis are interfered with.

There may be diffuse tenderness in the epigastrium, largely through the gastric hyperæsthesia accompanying. The gastric motility may be normal, increased, or diminished. Hypermotility (too rapid passage of the ingesta into the bowel) is more common than atony; the latter, though, is not unusual.

*Diagnosis.*—This affection is differentiated from ulcer chiefly by the fact that the disagreeable sensations, or pain, in the former are almost invariably dissipated by the taking of food or a full dose of an antacid. Other differential points are the absence of all, save occasional, vomiting, of hæmatemesis, of localized pain, and of chloranæmia.

*Treatment.*—The medical treatment is largely that of gastric ulcer: the free use of antacids three to four hours after a meal (the dose graded by the percentage of HCl excess, ascertained by several examinations of the stomach-contents), and the local use of silver, alumnol, and of moderate doses of bismuth. Most important is removal of any apparent underlying cause, improvement of the general health, and an out-of-door life. The amount of carbohydrates in the food must be restricted, as must the in-take of table-salt. When carbohydrates are eaten, diastase should be coincidentally taken. Then, too, chewing gum for a

half-hour after a meal is often of value. Nervines—such as arsenic, asafoetida, valerian, and sumbul, in neurotic cases—and nerve-sedatives—such as the bromides, and especially strontium bromide—are often indicated.

GASTROSUCCORRHŒA PERIODICA (PERIODICAL EXCESSIVE SECRETION OF GASTRIC JUICE; GASTROXYNSIS).—In this affection periodical attacks of excessive gastric secretion occur independently of the stimulus of food, and are associated with gastric distress, pain, nausea, and vomiting. The pain may have origin at the site of the pylorus or the cardia, thence radiating, or it may exist primarily as a diffuse gastralgia. The attack lasts from a few hours to several days, and occurs at intervals of days, weeks, or months, during which no gastric symptoms may be evident and no abnormality of the gastric functions exist. The attacks are sometimes associated with typical migraine.

The affection occurs as a primary neurosis, or is dependent upon a central organic nervous disease, such as tabes.

*Treatment.*—As in the other gastric neuroses, the treatment essentially consists in building up the general health and in aiming at the eradication of the neurotic element present. If hyperchlorhydria exists in the interval, appropriate treatment for it is necessary. At the onset of an attack lavage with hot soda solution is advisable. By it, repeated at intervals, an attack may be aborted. If it cannot be employed, the induction of vomiting by drinking hot water containing sodium bicarbonate is often of service. Otherwise the treatment of the paroxysm is similar to that of gastralgia. During and shortly after the seizure the diet must be of the blandest sort, similar, indeed, to that suggested in ulcer subsequent to bowel-feeding.

GASTROSUCCORRHŒA CONTINUA CHRONICA (CHRONIC CONTINUOUS FLOW OF GASTRIC JUICE; REICHMANN'S DISEASE).—This is an affection in which the stomach, even during the fasting state, is never free from a considerable quantity of gastric juice, due to its constant excessive secretion. This affection is rare as a primary neurosis, although the writer has seen several undoubted cases. In most of the observed cases there co-exists benign pyloric stenosis (often due to hyperplasia), and consequent dilatation of the stomach.

Latent ulcer has also been noted with this affection. There is always a considerable quantity of gastric secretion in the fasting stomach in the morning. This macroscopically may not show evidence of food-elements, but, microscopically, starch-granules, etc., can commonly be made out. Sarcinæ are not evident unless with a considerable degree of atony. The disease may exist quite symptomless, with preserved health, or there may be present (as a result of marked gastric myasthenia) the usual indications of stenotic dilatation.

The symptoms accompanying this affection are largely those of hyperchlorhydria. With these, regurgitation or vomiting of a highly acid or normally acid gastric juice is common, and may be associated with more or less gastric uneasiness or even with attacks of gastralgia. The writer has under observation two cases in which attacks of typical pylorospasm occur. Symptoms indicative of a neurosis are usually evident. In cases in which there is pyloric stenosis and dilatation symptoms of these are usually evident. The treatment is that of the underlying neurosis plus that for the hyperchlorhydria. The in-take of fluids must be limited, as in gastric dilatation.

SUBACIDITY OF THE GASTRIC JUICE, OR HYPOCHYLIA. — This is a condition occurring in neurotic or in neurasthenic subjects, in which, without indications of gastritis, there is secreted an abnormally small amount of HCl and of the ferments. The condition may alternate with periods in which hyperchlorhydria or even actual achlorhydria is present. Atony of the stomach not unusually accompanies subacidity of the gastric juice. The treatment consists in building up the general health, special treatment for the neurosis, and the use of diluted HCl after meals, in combination with strychnine, or with nux vomica, and with certain others of the vegetable bitters. Intra-gastric faradism and galvanism are of value, as is general electrical treatment for the neurosis.

TOTAL ABSENCE OF THE GASTRIC SECRETORY FUNCTION (ACHYLIA GASTRICA; ACHLORHYDRIA; NERVOUS ANACIDITY; ATROPHY OF THE GASTRIC TUBULES; ANADENIA VENTRICULI.—As remarked before, this curious affection, although classed among the neuroses and functional diseases of the stomach, is often dependent upon an actual atrophy of the gastric tubules, which may have been due to a granular gastritis, symptoms of which last had not been evident. The writer has described this affection at length in the Amer. Jour. of the Med. Sci., Nov., '95. The history of the cases he there details and that of certain others he has since observed renders it not improbable, as he there holds, that many cases of this affection originate as a local exhibition of a general neurosis or as a general neurasthenia, or through some process of nervous inhibition. Through a long-continued action of the causative factor, the suppression of function leads finally to atrophy of the non-secreting glands, without the existence of a pre-



ceding or accompanying gastritis. It is, however, important to note that in a number of cases studied by Hemmeter, from which he was able to obtain fragments of the gastric mucosa, in nearly all glandular gastritis was evident with the glandular atrophy.

In cases of absence of the secretory function the acidity of the gastric contents is persistently practically *nil*, being merely that of the food previously ingested, macerated in the fluid coincidentally taken. The gastric contents for purposes of testing must be removed by the tube at a time after a meal when digestion should normally be at its height and a fair amount of free HCl evident. The acidity of the filtrate then, after the simple meal of bread and water (2 ounces of bread; 12 ounces of water),—the contents removed in one hour from its ingestion,—is from 4 to 8, instead of from 30 to 60, as calculated on 100 cubic centimetres of the gastric filtrate, a measured amount of which is titrated with decinormal sodium hydrate. Pepsin and lab-ferments are absent, but traces of the pro-ferments are usually evident. (For detail of methods of examination, see the paper on this subject referred to.)

This disease may exist quite symptomless and with preserved general health, or there may be present (as a result of a coincident marked atony of the stomach) anæmia and dyspeptic symptoms referable to the atony. Gastric carcinoma should be carefully searched for.

The treatment consists in endeavoring to restore the secretory loss, if it is suspected that atrophy of the tubules has not yet occurred. The use of the intragastric douche with weak solutions of HCl, and a bitter infusion, alternated with douches of soda and of salt; the daily employment of intragastric electricity, and of HCl before meals, all as

detailed in the treatment of chronic gastritis, are then worthy of trial. If impairment of the motor function exists, this, at least, is benefited or removed by this treatment even if secretory loss cannot be restored through atrophy of the glandular elements. Attention to the general health is of prime importance; the accompanying neurasthenia or the manifestations of a neurosis must receive the most intelligent management.

Later, when persistent efforts to restore the secretory function are resultless, the further use of HCl is unnecessary. Intra-gastric electricity is then employed, if at all, merely for its effects on motility. It is useless in any stage of this affection to administer HCl and pepsin, expecting to obtain a digestive effect. An active papain and diastasic preparation must be employed instead, or an extract of the pancreas used, if the indications, such as debility and blood-impoverishment, suggest that digestion in the bowel by aid of the pancreatic secretion, is not occurring.

**The Motor Neuroses.** — **HYPERMOTILITY** is that condition in which the gastric motor function is abnormally increased, the stomach-contents passing too rapidly onward into the bowel before gastric digestion has been completed. Hyperchlorhydria very commonly co-exists with hypermotility, and is presumed to originate the latter sometimes.

The treatment of hypermotility is largely that of hyperchlorhydria.

**PERISTALTIC UNREST (KUSSMAUL); TORMINA VENTRICULI NERVOSA.** — In this condition there is a markedly exaggerated condition of gastric peristalsis, which is not only subjectively evident to the patient as a disagreeable sensation in the epigastrium or actual pain, but which may often be evident to the examiner. Waves of peristalsis are then noted passing from left to right, and sometimes in

a reverse direction. *Tormenta ventriculi* is commonly associated with pyloric stenosis with gastric dilatation, but rarely it occurs as a pure neurosis without accompanying organic disease, and attacks of pylorospasm are coincident.

The treatment is that of the underlying affection plus that for gastric hyperæsthesia given.

**NERVOUS ATONY OF THE STOMACH.**—Atony of the stomach is technically a condition in which delay, more or less marked, in the passage of food into the bowel occurs, not dependent upon obstruction at or beyond the pylorus. The stomach still retains its normal size when empty, and food is rarely found in the fasting organ in the morning, some ten to twelve hours after its ingestion. Simple atony may occur as a pure neurosis, and as such is common in neurasthenics. It then is often but a transient affection, due directly to some pronounced mental disturbance. Atony of the stomach may be more or less constant as an accompaniment of certain debilitated constitutional states, such as general neurasthenia, tuberculosis of the lungs, simple anæmia, etc. Atony of the stomach occurs both as a primary neurosis or as one secondary to other nervous affections of the stomach, such as pylorospasm and hyperchlorhydria. It is usual in gastroparesis.

*Symptoms.*—These are sensations of uneasiness, weight, and fullness in the epigastrium after meals; eructations of gas; perhaps headache; and a tendency to vertiginous attacks. Anorexia and usually constipation are present. A splash-sound is readily produced some hours after food or drink, even when but a small quantity of fluid is present in the stomach. Examination with the tube shows the presence of food some hours after the stomach should have emptied

itself. (For further symptomatology see **DILATATION OF THE STOMACH.**)

The treatment is that of atonic dilatation (which see) plus that of the neurasthenia or underlying neurosis.

**RUMINATION (MERYCISM).**—This is a gastric neurosis characterized by habitual regurgitation of small quantities of food into the mouth for several hours after its ingestion, which regurgitated food is not expectorated, but rechewed and re-swallowed, all after the manner of the ruminant. The affection occurs in neurotic individuals, and is often preceded by a more or less long period in which nervous disturbances of digestion have occurred and simple regurgitation of food has been common. This disease, as with insufficiency of the cardia and with simple regurgitation, is presumed to be due to an increased irritability of the vagus nerve. The onward passage of food into the bowel may be normal or atony may exist; the secretory function may be in a state of exaltation or depression; no relation seems to exist between the motor and secretory functions and rumination.

*Treatment* must be directed to the underlying neurosis. Moral suasion, in which insistence upon constant autosuppression of the regurgitation is urged, is most important. Hypnotic suggestion is always worthy of trial. Thorough preliminary mastication of food must be urged. The use of a pronounced bitter drug after meals, such as quinine, as suggested by Hemmeter, is worth a trial.

**NERVOUS ERUCTATIONS.**—This affection is common in neurasthenic and neuropathic individuals or in the otherwise robust after mental strain or worry. It exists either as an ephemeral or a chronic condition. Eye-strain may be a factor. The gas is paroxysmally expelled. It is tasteless and odorless, and may arise from the stomach or merely from the œsophagus.



gus, consisting of air that has just been swallowed.

PNEUMATOSIS is a condition allied to the foregoing in which, in consequence of spasmodic closure of the orifices of the stomach, this viscus becomes markedly and painfully distended with air. Dyspnoea and great subjective discomfort is thus produced.

*Treatment of Nervous Belching and Pneumatosis.*—The underlying neurosis or neurasthenia must receive attention. Among drugs the bromides, arsenic, and strychnine are of value. Boas favors the following in pill, three times daily:—

R Extract of physostigma,  $\frac{1}{10}$  grain.  
 Extract of belladonna,  $\frac{1}{5}$  grain.  
 Strychnine sulphate,  $\frac{1}{40}$  grain.—  
 M.

Intragastric electricity is recommended, but the writer has had little success with it in his cases.

NERVOUS VOMITING may occur as an idiopathic condition, without primary gastric disorder or obvious reflex cause, then dependent upon a neuropathic condition; or it may have origin in a reflected disturbance, such as in disease of the brain (meningitis, tumor, etc.); disease of the spinal cord (tabes, causing gastric crises); disease of the kidneys (vomiting of uræmia or that due to stone in the kidney), etc. The vomiting occurring in the early months of pregnancy is a well-recognized form of reflected gastric disturbance. Nervous vomiting is especially characterized by its occurrence independent of irritation of the stomach by food, and in one in whom previously the gastric functions may have been practically normal; by its precipitate onset, as in cerebral disease, without marked or any preliminary nausea.

Certain forms of nervous vomiting are described occurring in neuropaths, and

not dependent upon obvious reflex cause, such as the periodical vomiting of Leyden and vomiting occurring in profoundly neurasthenic subjects. Nervous vomiting is common in hysteria. In the periodical vomiting (of Leyden), a somewhat rare affection, periodical attacks of violent vomiting occur at regular intervals and in an otherwise healthy subject. The duration of an attack is from one to fourteen days. It is attended with prostration and resembles in its general character the gastric crisis of tabes.

An important feature of idiopathic nervous vomiting, and especially of that form occurring in hysterical subjects, is that, although it may persist over a very long period, the bodily nutrition does not especially suffer. Commonly in these subjects but a portion of the gastric contents is ejected during the act of emesis.

The treatment of a seizure of nervous vomiting is similar to that of the vomiting of gastric ulcer. In the interval the underlying neurosis must receive careful attention.

CARDIOSPASM—cramp of the inferior extremity of the pylorus and of the cardiac extremity of the stomach—occurs as a symptom of neurasthenia, hysteria, etc., and, as with pylorospasm, it is often symptomatic of certain nervous affections of the stomach, such as increased secretory activity, and increased sensibility of the mucous membrane (hyperæsthesia). Cardiospasm is observed in two forms: as a paroxysmal, transitory affection, lasting from a few hours to a day or two, and as a chronic ailment which may extend over a long period. The acute seizure resembles an attack of gastralgia save that the situation of the pain is in the region of the cardiac orifice, and thence extends into the back. There is attending gaseous distension of the stomach and dysphagia. In the chronic affection dys-

phagia is more or less constant, and may become habitual as time passes, coincident with dilatation of the lower end of the œsophagus. From this last a diverticulum ultimately results, much as is the case in organic stricture. The patient complains that the food does not enter the stomach. Regurgitation of unchanged food soon after its ingestion is then common. There is then absence of the second deglutition-murmur, normally heard immediately below the xiphoid appendix in a few seconds (2 to 10) after swallowing solids or liquids. From the chronic form of cardiospasm organic, malignant, and non-malignant stricture of the cardia must be separated. The treatment of cardiospasm is that of the underlying neurosis. In addition the systematic careful passage of a soft œsophageal bougie or the stomach-tube must be practiced. Thoracic aneurism must first be excluded.

**PYLOROSPASM**—spasm of the pyloric orifice of the stomach—is of less frequent occurrence than cardiospasm. Its existence has been questioned, but the writer has seen a number of undoubted instances. It occurs in neurotic, debilitated subjects, and is commonly associated with hyperchlorhydria, hyperæsthesia, and with simple atony or with dilatation of the stomach. Ulcer may be an exciting cause. In a case of undoubted pylorospasm recently under observation the symptoms, briefly, were: attacks of paroxysmal pain occurring a trifle below the right of the costal margin, at the junction of the eighth and ninth ribs, shooting thence through into the back and across the abdomen. Uneasiness and pain in the pyloric region lasting a half-hour or more would precede the paroxysmal pain. The attacks were induced by eating when overfatigued, and occurred nearly always be-

tween 12 and 3 in the morning. The patient was of spare build and of nervous temperament. He was neurasthenic, overworked, and was greatly given to worry. The attacks usually were of from one to two hours' duration. Vomiting only occurred if self-induced and then cut the attack short. Lavage with hot soda solution always had a similar, but more prompt, effect. The stomach-contents obtained by the tube during a seizure usually amounted to a litre (acute atony) and the acidity was high, equaling 0.3 to 0.35 free HCl (hyperchlorhydria with hypersecretion).

The treatment of pylorospasm is, as with the foregoing, attention to the underlying neurosis, and, coincidentally, treatment of the associated gastric affection. In cases associated with hyperchlorhydria and with hypersecretion, the local employment of silver, alumnol, and of bismuth, as detailed in the treatment of ulcer and of simple hyperchlorhydria, has been of extreme value in the writer's hands. The case mentioned was cured by this means.

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**STRABISMUS.**—From the Greek *στραβιδμός*, to squint.

**Synonyms.**—Squint; heterotropia.

**Definition.**—The condition in which both eyes do not look toward the same point; but when one eye fixes a certain point the other is turned elsewhere.

**Symptoms.**—The false position of the eye that is not turned toward the object looked at is usually noticed on casual inspection, and constitutes a very disagreeable deformity. This eye is called the *deviating eye*. The one which is normally directed is the *fixing eye*. The symptom of deformity may, however, prove misleading. The direction an eye



is looking is judged by the direction the cornea is turned. In some eyes the visual axis pierces the cornea so far from its centre that the eye appears to deviate when in reality it is properly directed; and such an eye might really deviate when it appeared straight.

The lack of correspondence between the eyes prevents true binocular vision, if that function has already been developed; or prevents its development. If the patient has previously possessed normal binocular vision the deviation causes diplopia or double vision. This diplopia is distinguished from monocular diplopia by the fact that the covering of either eye removes it.

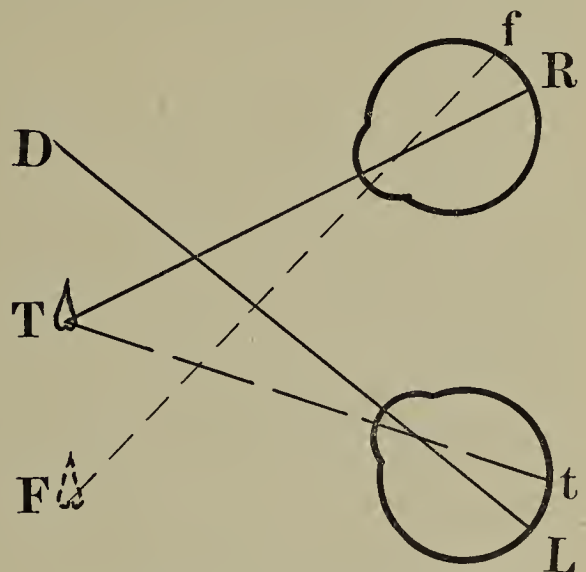
The image seen by the fixing eye is called the "true image," it being referred to the true position of the object. The image seen by the deviating eye is called the "false image," it being referred, in the consciousness of the patient, to a direction different from the real direction of the object. The relation of this diplopia to the deviation of the eye may be understood from the illustration here given. The visual axis  $R-T$  is properly directed toward  $T$ , the object looked at; but the other visual axis  $L-D$  deviates toward  $D$ . In the eye  $L$ , therefore, the image of  $T$  falls at  $t$ , on the nasal or inner portion of the retina; and it is referred or projected in the direction  $f-F$  as another object at  $F$ , the point  $f$  in the fixing eye corresponding to the point  $t$  in the deviating eye.

The direction of the false image is always the opposite of the direction in which the eye deviates. Thus, when the eye deviates upward the false image appears below. When the eyes are crossed we have *homonymous diplopia*; and, when the eyes diverge, *crossed diplopia*.

Diplopia disappears when the strabismus is corrected, or when one eye is

closed. It may also disappear through extreme deviation, causing the image in the deviating eye to fall on the extreme periphery of the retina, which is comparatively insensitive. Or it may disappear from habitually disregarding the false image, especially in early life. While, therefore, the presence of binocular diplopia proves the presence of strabismus, its absence does not prove that the eyes are properly directed.

**Etiology.**—The normal directing of the eyes depends on an extremely delicate system of reflex actions, which requires sufficiently good vision in both



Strabismus. (Edward Jackson.)

eyes and a central co-ordinating mechanism. The power of accurately co-ordinating the eye movements normally develops after birth. Arrest in its development may cause strabismus. Practical blindness of one eye, especially when it depends on some lesion of the cornea that causes distortion of the retinal images or the diffusion of unfocused light within the eye, is very likely to cause that eye to deviate.

Errors of refraction are a common cause of strabismus. Hyperopia of rather high degree, 2 D. or upward, compels excessive effort of accommodation, and

so brings about excessive convergence. Myopia of very high degree, 10 D. or more, is attended with elongation of the eyeball that makes it difficult to turn it in its socket. This leads to divergent squint through giving up of the effort to turn the eyes in, so strongly as would be necessary to fix both eyes upon an object so close to them. Difference of refraction between the two eyes, making it difficult or impossible for both to focus the object at the same time, also causes strabismus. Paralysis of one or more of the muscles that turn the eye disables it for certain movements and so causes strabismus. More rarely spasm of one or more of these muscles is the cause of a deviation.

Strabismus from lack of development of the co-ordinating mechanism, hyperopia, or difference of refraction between the two eyes develops in early childhood, when it is also most likely to arise from practical blindness of one eye. From myopia it occurs a few years later, as the myopia usually develops during the period of school-life. From paralysis of the muscles it may develop at any time of life. Syphilis and rheumatism are the most common causes of these palsies. But acute infectious diseases, especially diphtheria, injuries, and chronic diseases—as diabetes and Bright's disease—also cause them. Spasm of the muscles is apt to be hysterical.

The onset of convergent strabismus during the wearing of a bandage for injury or disease in childhood, or during any affection which temporarily prevents binocular vision, is not uncommonly observed. F. W. Marlow (*Ophthalmic Record*, p. 117, '97).

**Varieties.**—When strabismus is due to paralysis of certain muscles, causing inability to move the eye in certain directions, it is called *paralytic*. Where the squint is due, not to inability to move

the eye, but to a false co-ordination of the movements, so that while the two eyes move freely in all directions they still keep their false relation to each other (as always too convergent or too divergent, or one turned too high for the other) the condition is called *concomitant* or *comitant strabismus*.

When the eyes converge too much it is *internal* or *convergent strabismus*. When they diverge, or do not converge enough for near seeing it is *external* or *divergent strabismus*. When one eye turns higher than the other it is *vertical strabismus*. When it is always the same eye that deviates it is *monocular* or *monolateral strabismus*. When it is sometimes one eye, sometimes the other, that deviates, it is *alternating strabismus*. When a comitant deviation is always present, it is called *constant*, although it may vary much in degree; if sometimes absent it is called *intermittent* or *periodic*.

*Paralytic strabismus* only appears when the affected muscles are called on to perform their function. It is divided into varieties corresponding to the muscles affected, and usually spoken of as paralyse of those muscles; as paralysis of the internal rectus, paralysis of the inferior oblique. Paralysis of all the muscles supplied by a certain nerve-trunk may also be designated, according to the nerve affected, as *abducens paralysis*, *oculomotor paralysis*, *fourth-nerve paralysis*. Paralysis of all the extraocular muscles, *ophthalmoplegia externa*, causes some kind of squint whenever an attempt is made to look out of the direction in which the affected eye is turned. If both eyes are affected the strabismus is usually constant.

*Latent strabismus*, also called *heterophoria*, *muscular insufficiency*, or *imbalance*, or *dynamic squint*, is that condi-



tion in which a tendency to strabismus exists but is overcome by a special effort of the appropriate muscles, in order to avoid diplopia and preserve binocular vision. The insufficiency may be of any one or more of the muscles, shown only or chiefly when the particular muscle is called into action: a sort of lateral paralytic strabismus. Or it may be found to be about the same, whatever the direction in which the eyes are turned, a latent comitant strabismus. To the latter variety the term heterophoria (from the Greek ἕτερος, different, and φέρω, tending) may be applied. The varieties of heterophoria are *esophoria*, tending inward, latent convergent strabismus; *exophoria*, tending outward, latent divergent strabismus; and *hyperphoria*, tending upward, or latent vertical strabismus. The latter may be right or left according to the eye which tends to turn above its fellow. *Orthophoria*, right tending, or muscular balance, is the normal condition, the absence of heterophoria.

**Diagnosis.** — In a case of apparent strabismus we must first determine whether the apparent deviation is real. This is done by having the patient fix his gaze steadily upon some distant object; and then, while watching his eyes, covering first one and then the other, so that he is compelled to fix with them alternately. He will fix with the uncovered eye. Then on shifting the cover, if the other eye was also properly directed while it was covered, no movement will occur. But if the covered eye was deviating, it will have to move in order to fix the point looked at, and the eye which previously fixed will deviate; and these movements will be repeated every time the cover is shifted. The extent of such movements indicates the amount of the

deviation, and the direction shows the variety of strabismus.

The degree of lateral squint may be measured along the lower lid in millimetres of change in the direction of the eye from the deviating to the fixing position. But it is more accurately measured by the angle of deviation. This may be ascertained by placing the deviating eye at the centre of the arc of a perimeter, and directing the gaze toward a distant point in the axis of that arc. Then finding the point of the arc toward which the deviating eye is turned, we read off the angle of deviation. The point toward which the deviating eye is turned is ascertained by moving a candle-flame along the arc, until the surgeon's eye behind the flame sees its reflection in the centre of the pupil of the deviating eye. Priestley Smith's method is applicable without a perimeter. In it the surgeon reflects light on the deviating eye with a mirror held at his own eye one metre from the patient, and has the patient look at his finger, which is moved at a distance of one metre from the deviating eye until the corneal reflex from that eye appears at the centre of the pupil. The distance from the surgeon's eye to his finger is then the measure of the strabismus. It may be measured on a scale of tangents showing the degrees of squint, or each centimetre corresponds to about one centrad or four-sevenths of a degree. When there is diplopia the amount of squint may also be measured by the distance of the false image from the true image, or the strength of the prism required to bring them together.

To discriminate between paralytic and comitant strabismus, we must note if the deviation of the squinting eye or the separation of the true and false images is confined to a part of the field of fixation, or is greater in some parts than in others.

To ascertain which muscle or muscles are paralyzed, note the direction in which the eyes must be turned in order to produce the greatest deviation, or widest separation of the two images, this being the direction in which the paralyzed muscle is most needed to turn the eye. The false image, belonging to the eye which cannot be normally turned, always appears farthest in the direction the eyes are turned. Thus, on looking up, the false image appears higher than the true image; on looking to the right the false image appears the farther to the right. By alternately covering the eyes we can find to which eye the false image belongs, and so the exact muscle or muscles affected.

Diplopia is the rule in paralytic strabismus, unless one eye be blind or covered by a drooping lid; but it is the exception in comitant strabismus.

To recognize latent squint we must prevent binocular vision. To secure binocular vision the strabismus is rendered latent, and when the effort necessary to prevent strabismus no longer secures binocular vision it is given up and the eyes are allowed to deviate. Binocular vision is prevented by covering one eye. When this is done the covered eye deviates. But on removing the covering the eye quickly turns to the position of true fixation. The deviation of the eye under cover may be so slow as to be with difficulty noticeable; but the quick "recovery" when the cover is removed is very apparent.

By shifting the cover quickly from one eye to the other the eyes may be made to deviate and "recover" alternately. By so shifting the cover back and forth while the patient gazes at a distant lamp-flame, he will see the lamp-flame appear to jump back and forth from one position to another as the cover is shifted. The

direction in which the eyes deviate and "recover" and the direction in which the flame appears to jump will tell the variety of latent strabismus present.

Binocular vision may be prevented by making the image received in one eye so unlike the other that there will be little or no tendency to fuse them. This may be done by placing before one eye a dark-blue or purple glass. On looking at a distant flame the patient then sees two: one of the natural color, the other blue or pink. In orthophoria these appear superimposed; but with heterophoria they appear separated. The direction in which they are removed from one another indicates the kind and the distance the amount of latent strabismus.

Binocular vision may also be prevented by use of a prism which so displaces the image formed in one eye that it cannot be fused with the image formed in the other eye. Thus, in the "Graefe test" a prism of 8 or 10 centrads is held with its base up before one eye, and the gaze fixed upon a dot in the centre of a blank card. To the eye before which the prism is held the dot appears displaced downward. In orthophoria it appears directly below the true image. In esophoria the lower dot appears below and toward the side of the eye that sees through the prism; in exophoria downward and toward the opposite side. The phorometers of Stevens and others are mostly based on this principle.

The *Maddox rod-test* is really one in which one image is so distorted as to prevent its fusion with that of the other eye. A very strong cylinder, either a piece of a small glass rod or a concave cylinder of similar strength, is placed before one eye. Seen through this a point of light appears as a long streak. The other eye being left uncovered, the streak appears in orthophoria to pass through



the point of light. But in heterophoria the streak appears to pass to one side of the point of light. The side on which it appears to pass indicates the variety of latent squint, and the distance of the streak from the light, or the strength of prism required to cause it to pass through the light, shows the amount or degree of the tendency to deviation.

The method of measuring the amount of strabismus by prisms is applicable in all cases of manifest or latent squint in which the patient can recognize binocular diplopia. It consists in placing before the eyes such prisms as will cause the true and false images to coincide in spite of the strabismus. Such prisms will substitute binocular vision for diplopia; and will do away with all movements of deviation and recovery, or of apparent movement of the point of light looked at, when the cover is shifted from one eye to the other in rapid alternation.

**Prognosis.**—For apparent squint due to displacement of the cornea, we can do nothing except at the cost of binocular vision. Comitant strabismus is outgrown in a few cases in early childhood without treatment; and in a much larger percentage of cases may be permanently cured by the wearing of glasses, and proper orthoptic exercises. Comitant strabismus in adults, if intermittent, may be cured by correcting lenses; but if constant will generally require an operation. All cases of comitant squint are capable of relative cure by operations judiciously chosen and skillfully performed, except such as suffer from diplopia when the image is thrown on the fovea of the deviating eye. The exactness and permanence of the cure depend on the possibility of establishing true binocular vision.

Paralytic strabismus may be cured by cure of the paralysis causing it. If the

paralysis be very marked, it will probably not recover in less than six weeks, or after six months will not recover at all. After incomplete recovery from paralysis of one of the eye-muscles, operative treatment may give practical relief. Strabismus due to a permanent complete paralysis cannot be cured. The diplopia of comitant strabismus usually ceases to be annoying or disappears entirely. Diplopia from paralytic squint, except when it has occurred in childhood, will commonly last throughout life.

**Treatment.**—In every case of strabismus, any obstacle to easy binocular vision, in the form of an error of refraction, should be removed by the constant wearing of correcting lenses. All eye-work or habits tending to cause or perpetuate the strabismus should be discontinued. If due to an ocular palsy this should be treated. If of recent origin, orthoptic exercises should be resorted to. If the strabismus be constant and of long standing, and not much influenced by the wearing of correcting lenses, and if throwing the image on the fovea of the deviating eye when the fixing eye is also in use does not cause diplopia, an operation should be done.

Correction of any error of refraction is the first step. It may be done at a very early age. Children two years old can have their correcting lenses determined by skiascopy; and will readily and gladly wear them, if they are much needed and accurately adjusted. The avoidance of injurious use of the eyes may require the use of a mydriatic to suspend all effort of accommodation. Or it may include, for monolateral strabismus, the covering of the fixing eye, or the placing of it alone under the influence of a mydriatic, to compel the patient to use the eye he would otherwise allow to deviate.

*Orthoptic exercises* include: the viewing of special diagrams and pictures through the stereoscope; the exercise of muscles that are relatively inefficient by placing prisms so that they will bring the true and false images close enough together for the muscles to complete their fusion, in actual squint, or so that the prism will require special exertion to "overcome" it in latent squint. They also include the use of "fusion tubes," which are applied one to each eye and turned so that the eyes can just fuse the minute openings in the distal ends of the tubes. Also the employment of the "reading-bar," an opaque bar supported above the page in such a way that it cuts off a portion of each line from one eye, and another portion from the other eye, compelling fixation with both eyes for the reading of each line. Under this head also comes the practice of exercising convergence, by fixing on a point that is gradually made to approach the eye until the requirement of convergence becomes too great to be sustained. Or the practice of viewing through strong prisms, turned with the base toward the nose, a point which starts near the eyes, but is slowly withdrawn until the limit of the power of abducting the eyes is reached.

*Operations* on the ocular muscles are of two kinds: tenotomy, designed to lessen the influence of an overacting muscle; and advancement, designed to increase the influence of a muscle relatively weak or inefficient. Tenotomy is the simpler and less formidable operation. But it tends to lessen the total mobility of the eye, and if injudiciously performed may cause the eye to deviate in the opposite direction. Advancement is more difficult, but it does not lessen the mobility of the eye, and is not likely to cause a strabismus of the opposite kind.

For *tenotomy* the eye is cocainized and

the conjunctiva seized over the insertion of the muscle to be operated upon, and incised with a snip of the scissors. The incision may be small—4 or 5 millimetres (subconjunctival method)—or large 8 or 10 millimetres (open method). The subconjunctival tissue is then similarly raised and snipped through, down to the sclera. A strabismus-hook is now introduced beneath the tendon, and made to lift it from the sclera. One blade of fine, but blunt-pointed, scissors is then slipped beneath the tendon close to its insertion, and the tendon is divided at this point by the scissors.

For a *partial tenotomy* a small conjunctival incision is made over the centre of the tendon at its insertion, after which the tendon itself is caught up with the forceps and snipped through. Then, through the small central opening so made, a small strabismus-hook is introduced and the tendon divided on either side, until only a thin margin remains, which can be readily stretched with the hook. The subsequent stretching of these margins permits a slight retraction of the whole tendon.

To increase the effect of a tenotomy by permitting a greater retraction of the divided tendon, its lateral connections may be divided and the tendon thus isolated from all its attachments that indirectly connect it with the eyeball. Another measure is to keep the eye forcibly rotated away from the tenotomized muscle by what is called the *thread-operation*. In this a suture is inserted near the divided muscular insertion and made fast over a roll of adhesive plaster so as to keep the eye in position for the divided tendon to slip as far back as possible.

*Advancement* of the ocular muscles is done in several different ways. The natural insertions of the recti tendons are



from five to nine millimetres back from the margin of the cornea. The common operation is done through a free incision parallel to the corneal margin. The tendon is isolated, raised from the globe, its insertion divided, and brought forward to or near the corneal margin, where it is fixed by sutures. The sutures may be passed through firm scleral tissue or may only include conjunctiva and subconjunctival tissue, one passing above and another below the cornea. The former give the more certain and definite attachment, but the latter are easier to insert. When a marked deviation is to be corrected, advancement of one muscle is accompanied by tenotomy of its direct antagonist. Sometimes a portion of the advanced tendon is cut off (muscle-shortening). Sometimes the tendon is not divided at its insertion, but is folded upon itself, and so shortened (tendon-tucking). Some operators do not attempt to isolate the tendon, but pass sutures through the conjunction and capsule of Tenon. This is spoken of as *capsular advancement*.

After an operation for strabismus it usually is best not to keep the operated eye bandaged for more than a few hours, or, at most, a day or two. It should be brought into use with the other eye as quickly as possible, and correcting lenses worn constantly, and such use made of the eyes, or such orthoptic exercises resorted to, as will favor the perfecting of binocular movements and binocular vision.

*Prisms*, aside from their use as means of securing orthoptic exercise and training, are of value in relieving from some of the consequences of strabismus. In actual lateral squint they are scarcely applicable, because the squint is usually of such high degree that the necessary prism would be too thick and heavy to

wear. But for vertical strabismus, or for latent squint, they are often of great practical service. The apex, or thin part, of the prism is turned in the direction in which the eye turns or tends to turn. Thus, for right hyperphoria the prism for the right eye would be turned with its edge up, its base down. Turned in this way the prism does not "correct," but rather "permits" the deviation. But the prism removes the unpleasant effects of such a deviation, such as diplopia, or the strain of the ocular muscles necessary to preserve parallelism of the visual axes. Prisms may be valuable aids in establishing binocular vision after an operation on the eye-muscles or during recovery from paralysis of one or more of the ocular muscles.

In personal operation in cases of strabismus conjunctival incision is made close to the cornea, so as to leave no conjunctiva at this spot. The muscle to be advanced is then slightly separated from the surrounding tissue, but not extensively freed. A pair of squint forceps is now applied, and two silk sutures are put into the muscle rather far back, and the latter is divided between the forceps and the sutures. The tendon is cut right away from its attachment to the sclera. The sutures are then brought forward and inserted well into the episcleral tissue, and as close to the corneal limbus as possible. If, now, the eye is rotated toward the divided muscle by an assistant, the operator can tighten the sutures as much as possible, thus bringing the cut end of the muscle close to, or even overlapping, the cornea. In the latter case the free end may be incised in the middle, parallel to its fibres, so that the divided ends come to lie on each side against the margin of the cornea. In convergent squint atropine is applied to both eyes so as to induce more complete rest. Both eyes are bandaged for five days at least in divergent strabismus, and for several more days in convergent strabismus, so that there shall be no inducement for the patient to use his two

internal recti together. As soon as the advanced muscle or muscles are firmly attached, one eye is left open; and, after one or two weeks, methodical exercises of convergence are practiced with the proper correcting lenses before the eyes. It is important that the patient upon whom this operation is performed should be kept in bed with both eyes bandaged for the first few days. E. Landolt (*Archives of Ophthalm.*, Jan., '97).

Great importance is attributed to the immediate influence of the binocular function in establishing a perfect equilibrium after tenotomy while the tendon is more or less completely detached from the eyeball. This function compels the eye to occupy the position in which single vision is possible, and thereby helps to determine the point at which reattachment of the tendon shall take place. If, on the other hand, the eye is bandaged, it assumes its position of rest; there is no tension or straining of the tendinous fibres induced by the desire for binocular single vision, and the reattachment may take place at a point by no means the most favorable for that purpose. F. W. Marlow (*Ophthalmic Record*, p. 117, '97).

Analysis of 700 cases showed that it is impossible to determine what lenses are to be prescribed in ametropia unless a thorough knowledge of the performance of the muscular function is obtained. The addition of a vertical prism to the patient's curvature correction has often been fruitful of relief. The Maddox rod considered of great value in these cases. Hyperphoria occurs in about one-sixth of the patients, but only becomes worthy of special notice in one-fifth of the refraction cases. In 33 per cent. of all cases it becomes more manifest after the thirtieth year. Correction with prisms is of service in about 50 per cent. of all the cases. Exercising insufficient convergence and repressing an excess of convergence often bring about relief of the symptoms, which frequently are neuralgia, photophobia, and physical tiredness after continuous near work, the latter symptom generally being in disproportion to the amount of work done. As

a last resort, tenotomy of one of the vertical muscles will have to be performed. Wendell Reber (*Phila. Med. Jour.*, from *Jour. Amer. Med. Assoc.*, Jan. 19, 1901).

The purpose of treatment of strabismus is threefold: To remove the deformity; to establish normal association of movement between the eyes, and to reclaim the deviating eye from amblyopia. Free tenotomy is not recommended, and advancement with previous thorough stretching of the muscle is preferred. J. H. Woodward (*New York Medical Journal*, Jan. 24, 1903).

The writer designates the fusion centre as the dominant centre of the visual apparatus and from it must emanate all the impulses to the various subsidiary centres for all changes in the accommodation, position of the visual axes and positions of the head and body that are required to bring corresponding retinal points into focus. Any disturbance or condition of non-development of this centre is the cause of those heterophorias or heterotropias not due to abnormalities in the anatomic relations of the orbit and extrinsic muscles or their paralyses. If the treatment does not result in parallelism of the visual axes and operation has to be resorted to, the fusion centre, being in a developed condition, can proceed with its function as soon as the visual axes are made parallel. N. M. Black (*Transactions American Medical Association*, May, 1903).

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**STRONTIUM.**—Strontium is an alkali metal having a yellow color. It oxidizes quickly on exposure to the air, and must be kept under naphtha, benzene, or other liquid free from oxygen, like the other alkali metals. Strontium forms salts with the acids and with bromine, chlorine, fluorine, etc. Three salts are official: the bromide, the iodide, and the lactate.



Strontii bromidum (U. S. P.) occurs in long, deliquescent colorless needles, having a bitter, saline taste. It is soluble in alcohol, in 1.05 parts of cold and in 0.5 part of boiling water. This salt must be kept from the air.

Strontii iodidum (U. S. P.) occurs in white, or faint-yellowish, microcrystalline, deliquescent powder or in almost colorless, hexagonal plates, having a bitter, saline taste. It is soluble in alcohol and in ether, in 0.6 part of cold and in 0.27 part boiling water. This salt must be kept from the light and air.

Strontii lactas (U. S. P.) occurs as a white, granular powder, having a slightly-bitter taste. It is soluble in alcohol and in 4 parts of cold and in 0.5 part of boiling water. This salt is unaffected by the air.

Strontii acetas occurs as a white, crystalline powder, soluble in water. It is used as an anthelmintic and intestinal tonic. Dose,  $\frac{1}{4}$  to  $\frac{3}{4}$  grain.

Strontii nitrate occurs in colorless crystals, soluble in 1.4 parts of water and slowly in alcohol. It is not official. Dose, 5 to 20 grains.

Strontii salicylate occurs in octahedral crystals soluble in water and in alcohol. It is not official. Dose, 10 to 40 grains.

**Preparations and Doses.**—Strontii bromidum (U. S. P.), 5 to 30 grains.

Strontii iodidum (U. S. P.), 5 to 30 grains.

Strontii lactas (U. S. P.), 5 to 30 grains.

**Physiological Action.**—The strontium salts do not seem to produce any profound effect upon the human system. They appear to improve the nutrition of the body, and have not been taken in sufficient dose to produce distinct symptoms; no case of poisoning from these salts has been reported. The presence of even a minute portion of barium, how-

ever, makes the preparation violently poisonous. The dominant action of the strontium salts is that of the substance with which the strontium is combined. Strontium bromide, having the action of a bromide, is a nerve-sedative and antispasmodic. Strontium iodide acts as an iodide, and is an alterative and sialogogue. Strontium lactate appears to have the power of diminishing or arresting the excretion of albumin, without, however, increasing the amount of fluid excreted.

Strontium salts are eliminated to a relatively small extent only by the kidneys even after direct introduction into the circulation. The excretion in the urine begins soon, and ceases usually within twenty-four hours. The larger portion eliminated is found in the feces, whether the introduction be per os, subcutaneously, intravenously or intraperitoneally. The place of excretion is apparently restricted to the region of the alimentary tract beyond the stomach. A functional relation to certain phenomena of intestinal peristalsis is suggested. The rate of elimination is slow, and is apparently influenced by the calcium content of the food. Strontium is found deposited in the body chiefly in the bones; traces may be met with in the liver and muscles. L. B. Mendel and H. C. Thacher (Amer. Jour. of Physiol., Apr. 1, 1904).

Concerning the influence of the salts upon the circulation, full and satisfactory reports have not been made. Lanicque and A. Malbec (Compt. Rend. de la Soc. de Biol., iv, '92) assert that strontium iodide produces a primary pronounced elevation of the arterial pressure, with a lessening of the number of the heart-beats, and, after a time, if the dose has been large enough, a marked fall of pressure accompanied by a very feeble, rapid action of the heart. Binet states that in poisoning by the strontium salts, although the cardiac beat is very

feeble, the arrest finally takes place in systole.

The absorption of the strontium salts and their elimination, chiefly through the kidneys, appears to be rapid. Laborde states that the lactate and tartrate have a positive and marked diuretic and antiseptic action, and exert a profound influence in the alimentary canal and upon the excretions with which they are voided from the body. It is claimed that the strontium salts are only partially eliminated in the urine and fæces, a portion being retained within the body, and deposited in the bowels, liver, and, to a less extent, in the soft tissues.

**Therapeutics.** — **GASTRO-INTESTINAL DISORDERS.**—In the treatment of acute gastritis, Carselli, of Palermo, has found the bromide a remarkably efficient remedy, given in doses of 10 grains, three times a day, with or after meals. It is said to stop the vomiting and lessen the pain, which it accomplishes not only by a direct action upon the nervous system, but also through its action as an antiseptic by arresting fermentation and diminishing flatulence.

In hyperacidity of the stomach and in acid dyspepsia the lactate has been found to aid the digestion, inhibit fermentation, and act as a general tonic to nutrition. It has also proved efficient where there was a deficiency of hydrochloric acid.

In chronic gastric and intestinal catarrh the lactate is an efficient remedy.

The digestive disturbances associated with diseases of the heart and kidneys are notably ameliorated by the bromide. Nervous dyspepsia and gastralgia, nervous vomiting, and dilatation of the stomach are all amenable to the action of the bromide.

Strontium salicylate, although not official, has been used in the treatment of flatulent dyspepsia and intestinal fer-

mentation. It is said to be well borne and to improve the digestion. It is given in doses of from 5 to 10 grains after meals and is best given in capsules. For use as an intestinal antiseptic, the salicylate may replace, with advantage, salol, naphthol, etc.

The lactate is said to be an efficient tæniacide, given in a 15-per-cent. solution in water and glycerin, the dose being 1 tablespoonful twice daily for five consecutive days.

**RHEUMATISM AND GOUT.**—In rheumatism and gout the lactate has been found to exert the general favorable action of the strontium salts upon the alimentary canal, to increase nitrogenous elimination, and to cause the disappearance of the urates. Although the usual dose is from 20 to 30 grains, given in solution, three times a day, much larger amounts have been exhibited without causing untoward symptoms.

The salicylate has been given with good results in muscular and subacute rheumatism, and in chronic gouty manifestations accompanied by digestive disturbance.

Rheumatic manifestations often yield promptly to the iodide. It is particularly efficient in chronic, subacute, and muscular rheumatism. Sciatica and trifacial neuralgia, dependent upon a rheumatic taint, will often yield to this remedy. It is likewise of avail in chronic and subacute gout. The nitrate, in 30-grain doses, has been used advantageously in articular rheumatism.

**CUTANEOUS DISORDERS.**—In eczema dependent upon Bright's disease and psoriasis due to a rheumatic diathesis, the lactate effects improvement. The bromide affords signal relief in senile pruritus.

Lichen scrofulosum, strumous acne, and eczema, and other affections of the



skin occurring in scrofulous subjects, are improved by the administration of the iodide. It is likewise beneficial in chronic eczema with excessive infiltration and thickening of the skin. In lupus vulgaris the iodide is a good systemic remedy. Eczema, erythema multiforme, erythema nodosum, purpura rheumatica, psoriasis, and paræsthesia, caused by gout or rheumatism, are benefited through the use of this salt. J. V. Shoemaker has seen good results from the use of the iodide in the treatment of large pustules of the scalp, tubercular syphilides, and in all the later manifestations of syphilis.

**GENITO-URINARY DISORDERS.**—In chronic Bright's disease G. Sée and others have found the lactate a valuable remedy, as it diminishes or arrests the secretion of albumin, sometimes increases the amount of the urine, and improves the general nutrition. In albuminuria due to pulmonary congestion, it is said to be of no service. In desquamative nephritis its good influence is especially marked; it is much less pronounced in interstitial nephritis. In many cases there is no increase in the flow of the urine, and the good achieved seems to be due to an alterative influence upon the secreting structure of the kidney (H. C. Wood). The lactate is efficacious in scrofulous, gouty, and rheumatic nephritis, and in the albuminuria of pregnant and puerperal women, and in that of cardiac origin, but is of no service after the manifestations of uræmia appear.

In diabetes the bromide has been observed to have a decided effect in reducing the amount of sugar excreted in the urine.

**CONSTITUTIONAL DISORDERS.**—In certain constitutional disorders the iodide is an excellent remedy. It is valuable in the treatment of enlarged lymphatic glands, scrofuloderma, chronic abscesses,

diseases of the bones and joints, in scrofulous otorrhœa, ozæna, and ophthalmia. The iodide was introduced as a means of obtaining the alterative influence of an iodide without causing irritation of the intestinal tract or depression of the general nutrition. This salt contains about 56.5 per cent. of iodine, and may be substituted for potassium iodide with advantage.

**CARDIAC AND VASCULAR DISORDERS.**—Germain Sée recommends the use of the iodide in various affections of the heart. It may replace potassium iodide in the treatment of aortic aneurism. Experience has shown it to be useful in arteriosclerosis and in angina pectoris. Laborde and A. Malbec conclude that the iodide has a decided influence upon the heart, and is of service in affections of the myocardium and in lesions of the aortic valves and the arteries. This salt can be safely given in comparatively large doses, and may replace the potash salt whenever the latter is not well borne.

**NERVOUS DISORDERS.**—In epilepsy the bromide, in doses of from 40 to 80 grains daily, has been employed with satisfactory results. It is tolerated by the stomach, and has not, as yet, given rise to bromism. The paroxysms of hystero-epilepsy have also been controlled by this salt. In true epilepsy it diminishes the frequency of the paroxysms better than the potash salt; an improved mental condition and lessened somnolence and excitability commend it over the other bromides; moreover, this salt usually improves the appetite and digestion. H. C. Wood used the bromide chiefly as an adjuvant to ammonium bromide, as the strontium salt seems to have less control over the epileptic paroxysms than the older bromides.

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**STROPHANTHUS.**—*Strophanthus* (U. S. P.) is the seed of *Strophanthus hispidus*, De C., deprived of its long awn. The plant itself is a climbing apocyanaceous pod-bearing shrub of the western part of Africa. The seeds within the pods are abundantly provided with very large, deciduous hairs, which are apt to be shed within the pod itself, and are so numerous as to weigh nearly as much as the seeds. The seeds contain a white, intensely bitter, crystalline principle called strophanthin, which is a glucoside, partly soluble in water and in alcohol. *Strophanthus* is not official, but may be given in doses of from  $\frac{1}{300}$  to  $\frac{1}{120}$  grain. The tannate of strophanthin occurs as a yellowish-white amorphous powder, soluble in alcohol, containing 58.14 per cent. of strophanthin, and although not official may be used in the same manner as strophanthin in double the dose ( $\frac{1}{150}$  to  $\frac{1}{60}$  grain), as it is more easily taken. The preparation generally used is the official tincture (tinctura strophanthi, U. S. P.), containing 5 per cent. of the drug, which may be given in doses of from 3 to 10 minims.

**Physiological Action.**—According to Drasche, in the healthy man *strophanthus* in sufficient dose produces a fall in the rate of the pulse, with increase of arterial pressure, without any effect upon the respiration. If the dose has been sufficiently large, it produces gastric irritation and a slight fall in temperature. The hypodermic injection of 15 drops of the tincture induced violent local irritation, repeated vomiting with nausea, pronounced diuresis, and a fall of the pulse. Twenty drops by the mouth decreased the pulse 30 beats. Although *strophanthus* is primarily a muscle-poison, it probably has little or no effect upon the nerve-centres or nerve-trunks unless locally applied. It is locally irri-

tating and stimulating to the gastro-intestinal mucous membrane, and even to a greater degree to the secreting structure of the kidneys. *Strophanthus* is probably excreted by the kidneys, escaping with the urine.

*Strophanthus* is a pure heart-muscle poison, which kills by bringing about diastolic cessation of heart-action. Intoxication gives rise to characteristic changes in pulse and blood-pressure which differ from those caused by *digitalis*, mainly in the absence of vagus irritation. *Strophanthus* also brings about vascular contraction, but less so than *digitalis*, and it seems to have a specific action upon the coming centre. The only antidote is artificial respiration; neither morphine nor chloral hydrate possess any efficiency. G. Günther (Therap. Monatshft., June, 1904).

**Poisoning by *Strophanthus*.**—The symptoms of poisoning by *strophanthus* are those of gastro-intestinal irritation (burning in the œsophagus and stomach and vomiting), with irritation or inflammation of the kidneys. Death occurs by reason of cardiac paralysis. The treatment of poisoning by this drug consists in the use of emetics, lavage of the stomach by means of the stomach-siphon, and the administration of one of the physiological antidotes, aconite or *veratrum viride*.

**Therapeutics.**—The indications for the use of *strophanthus* are similar to those of *digitalis*; it is conceded that it is quicker and less enduring, but less certain, in its action than *digitalis*.

In cardiac weakness a single dose usually produces a fall in the frequency and an increase in the force of the pulse in from one-half to one hour, the effects lasting from four to eight hours.

In acute collapse strophanthin may be given by hypodermic injection.

In pulmonary œdema and pronounced general dropsy due to cardiac disease,



strophanthus appears to be superior to digitalis, but for continuous use in cardiac disease digitalis is generally preferred, strophanthus being substituted when a very immediate, temporary effect or a temporary change of remedies is required. (H. C. Wood.)

In renal affections with secondary failure of the heart, it is a very valuable remedy. Rothziegel, Koralzewski, and H. Haas commend it highly, not only in chronic, but also in acute Bright's disease.

E. D. Ferguson recommends this drug in exophthalmic goitre, believing that it relieves the overtaxed heart by overcoming resistance in the systemic circulation. He advises the use of 8 minims of the tincture at first, gradually increasing the dose to 25 minims, several times a day.

The special advantages of strophanthus over digitalis are as follow: It does not produce gastric disturbances, and does not show cumulative action. The constriction of the vessels by digitalis may be a source of great danger, owing to the extra strain thrown on the ventricle, especially in fatty heart. Strophanthus has no such tendency. It acts quicker and with greater certainty. Owing to its ready solubility it is better for hypodermic administration, and the strength of its preparations can be more easily standardized. E. M. Houghton (Jour. Amer. Med. Assoc., Sept. 11, '97).

To maintain the effect of the drug it should be given at least every eight hours. The tincture is too irritating for hypodermic use. Strophanthus by hypodermic injection has shown perceptible action within five or ten minutes. The maximum daily dose of strophanthus is  $\frac{1}{100}$  grain.

Strophanthus cannot be compared to digitalis in the constancy of its effects. Nevertheless, in certain cases it succeeds when digitalis has failed, and it is of value in replacing digitalis during the periods of treatment in which that drug

is suspended for the purpose of avoiding its cumulative effect. It has no marked action upon either the vessels or the arterial pressure. It is, therefore, preferable to digitalis in all cases in which arterial tension is evidently a source of embarrassment to an enfeebled heart. The dosage is very irregular. In order to avoid its toxic effects, and at the same time secure its real benefits, it should be given in progressively increasing doses, till the physiological indication has been fulfilled. There are only two preparations of value, namely, the extract and strophanthin; the tincture is very unreliable. The extract is to be given in doses of from one to six milligrammes, several times a day, its effect being watched. The dose of strophanthin is one-tenth as large. Martinet (Ann. Polyclinique de Paris, Jan., 1902).

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**STRYCHNINE.** — Strychnine (strychnina, U. S. P.) is an alkaloid obtained from nux vomica (*Strychnos nux-vomica*; nat. ord., *Loganiaceæ*) and from other plants belonging to the same natural order. Strychnine occurs in small, hard crystals having a very bitter taste, and is soluble in 7 parts of chloroform, in 110 parts of cold and in 12 parts of boiling alcohol, and in 6700 parts of cold and 2500 parts of boiling water. In addition to its medicinal uses it is employed as a poison for rats, mice, foxes, and wolves. Strychnine forms many salts, of which the sulphate is official.

Strychnine sulphate occurs in white, odorless prisms, having a very bitter taste, which effloresce in dry air. It is soluble in 50 parts of cold and in 2 parts of boiling water, and in 109 parts of cold and in 8.5 parts of boiling alcohol.

**Preparations and Doses.** — Strychnina (U. S. P.),  $\frac{1}{60}$  to  $\frac{1}{20}$  grain.

Strychninæ sulphas (U. S. P.),  $\frac{1}{32}$  to  $\frac{1}{12}$  grain.

Ferri et strychninæ citras (U. S. P.), 1 to 5 grains. (See IRON.)

Syrupus ferri, quininæ, et strychninæ phosphatum (U. S. P.),  $\frac{1}{2}$  to 1 drachm. (See PHOSPHORUS.)

**Physiological Action.**—In small therapeutic doses strychnine produces very little disturbance of the system, but acts as a powerful bitter tonic. The administration of large therapeutic doses is followed by a marked general stimulation and increase of bodily tone, and, if the doses be larger, the respiratory centres are powerfully stimulated and the blood-pressure, pulse-beat, and pulse-rate are increased.

Strychnine acts the same upon almost all animals. Its local action is that of a slight irritant. When taken by man, in doses sufficient to produce sensible physiological effects, a feeling of restlessness appears, accompanied, perhaps, by tremblings in the limbs and some stiffness in the neck and jaws. The ingestion of larger amounts may be followed by general muscular twitchings, with stiffness of the throat and chest, and formications or other unnatural sensations under the skin may be present. In overdose strychnine produces spinal or tetanic convulsions.

**CEREBRUM.**—Strychnine appears to have little or no effect upon the cerebral cortical centres. According to H. C. Wood, the stimulation of the special senses sometimes seen in the beginning of strychnine poisoning is probably, though not certainly, peripheral in its origin, and consciousness is probably never directly affected by this drug.

**SPINAL CORD.**—Claude Bernard has denied that strychnine produces excitation of the spinal motor centres, because, when all the posterior nerve-roots are cut, no convulsions occur, whereas, if a single afferent root be allowed to remain,

irritation of its peripheral fibrillæ will cause general tetanic spasms. While allowing the truth of the experimental fact, Wood does not agree with his deduction, and considers it proved by the experiments of Van Deen and others, including himself, that strychnine is a powerful stimulant to the cells of the spinal cord, including in this term the whole spinal tract up to the pons Varolii. Spitzka has shown that enormous doses of strychnine injected intravenously kill almost instantaneously without the production of a spasm, probably, as Wood suggests, by killing the nerve-centres, in the same manner that large doses of a cardiac stimulant overwhelm and paralyze the heart.

**MOTOR NERVES.**—From the experiments of Vulpian, Reichert, and H. C. Wood, it may be considered proved that in the warm-, as well as in the cold-blooded animals strychnine depresses directly the motor nerves, although it is probable, as is insisted upon by Poulsson, that the spinal cord is also paralyzed, because in certain frogs, and also in mammals, the paralysis appears to be complete at a time when the motor nerves are still capable of responding to stimuli (H. C. Wood).

**CIRCULATION.**—Strychnine has a very decided effect upon the circulation. Richter, Mayer, Schlesinger, and Klapp have noted a decided rise of arterial pressure before or about the time of the first convulsion, not due, however, to the convulsion, as it occurs in curarized animals in which artificial respiration is maintained. Mayer and Richter affirm that the rise of arterial pressure is due to stimulation of the vasomotor centres. Klapp and Reichert have shown that primary stimulation of the vasomotor centres by strychnine is followed by a fall of arterial pressure and vasomotor



paralysis; also that very large doses produce an immediate depression of the vasomotor centres and a fall of arterial pressure. An increase in the pulse-beat and in the pulse-rate follows after the injection of moderate doses of strychnine, probably due to a stimulation of the heart-muscles and its ganglia. When injected intravenously in large doses, Reichert noted, at first, a transient increase of pulse-rate, due to the immediate, overwhelming action of the undistributed strychnine upon the inhibitory apparatus of the heart; second, a lessening of the pulse-rate, due to slight stimulation of the pneumogastric endings; third, a marked increase in the pulse-rate, due to pneumogastric depression; and, finally, a decrease in the pulse-rate, due to an influence upon the heart-muscle or its ganglia.

**RESPIRATION AND TEMPERATURE.**—Strychnine is among the most constant and powerful of the respiratory stimulants. In a series of very careful experiments H. C. Wood found that the injection of strychnine produced in the dog an extraordinary increase in the respiratory air-movement, which was never less than 75 per cent., and sometimes rose to 300 per cent. A. Obermeier has found, experimentally, that small doses of strychnine produce in the rabbit no distinct alteration in the elimination of carbonic acid, but that after large doses there is a rise of the animal temperature and a very noticeable increase in the elimination of carbonic acid. It has been suggested that the increase in temperature which occurs after poisonous doses may be produced by the severe muscular action during the convulsions; small doses of strychnine have no apparent effect upon the body-temperature.

**ABSORPTION AND ELIMINATION.**—The absorption of strychnine is immediate,

and, according to R. W. Lovett, it accumulates especially in the spinal cord. Ipsen claims, however, that it is to be found in all the organs in direct proportion to the amount of blood going to them. It has been found in the brain by Grandval and Sajoux (*Union Méd. de Nord-est*, May, '92).

Strychnine is eliminated from the body by the kidneys, partly unchanged (Wormley, P. von Rautenfeld, Schauenstein, and others), and partly as strychnic acid. Schiff and Lautenbach believe that strychnine is oxidized and destroyed, at least in part, in the liver: a conclusion which is strongly combated by Chouppe and Pinet, and considered very doubtful by H. C. Wood. Strychnine may be found in the urine five minutes after its absorption (Ipsen). Kratter and Mann affirm that the elimination of strychnine is complete within forty-eight hours.

Personal experiments regarding the absorption of strychnine have established the following points:—

The absorption of strychnine in the stomach is incomparably lower than in any other section of the alimentary canal, and, furthermore, the absorbent power of the fundus seems to be even lower than that of the entire stomach. The power of absorption in the œsophagus is somewhat better than in the stomach, but is still considerably inferior to the absorption within the other parts of the alimentary canal. The power of absorption in the other three parts of the canal—*i.e.*, the small intestines, colon, and rectum—seems to be equal. The isolated rectum absorbs at least as well as the small intestines; in some experiments the effects appeared earlier when the rectum was isolated than when it had free connection with the remainder of the gut; from no part of the canal were such short intervals between the injection of the strychnine and the appearance of the tetanus observed as were frequently seen when it was injected into the rectum—in the latter case the inter-

val was sometimes only two or three minutes; finally, impaction of the rectum proved to be no hindrance to the prompt absorption of the poison therefrom. S. J. Meltzer (Amer. Jour. Med. Sci., Nov., '99).

Strychnine is deprived of its poisonous properties by prolonged contact with the tissues and juices of the body. In 12 guinea-pigs the authors ligated the thigh, tying the ligature so tight that nothing could pass into the general circulation, and injected a surely fatal dose of strychnine. In from one to four hours they removed the ligatures. None of the animals showed the least sign of strychnine poisoning. Ernst von Czyhlarz and Julius Donath (Centralb. f. innere Med., Mar. 31, 1900).

Investigation of the statement of v. Czyhlarz and Donath. Strychnine was used in frogs and rabbits because those animals show special sensitiveness to the drug. The results as to actually antidoting the strychnine in the ligated limb were negative in both. In guinea-pigs minimal doses were found to be much less violent in action, or the occurrence of convulsions were entirely prevented. In guinea-pigs (which are but slightly sensitive to strychnine) the application of a ligature prevents the absorption of this drug to some extent, but this is due to prevention of absorption, and not to actual antidoting of the drug. S. J. Meltzer and G. Langmann (Centralb. f. innere Med., Sept. 15, 1900).

**Poisoning by Strychnine.**—After poisonous doses of strychnine have been taken the symptoms usually appear in from fifteen to twenty minutes, rarely later than an hour, with great suddenness. Sometimes the convulsions are preceded by partial spasms of the muscles of the extremities, but more often the patient is suddenly thrown down by a general tetanic spasm (H. C. Wood). The condition is one of profound opisthotonos, the body is bent backward and rests upon the heels and head. The legs are extended, the feet everted, the arms bent, and the hands clinched. The eyes,

staring, are wide open, the corners of the mouth are drawn up (*risus sardonicus*). The face is at first pale, but may become livid from interference with respiration. Consciousness is not affected unless asphyxia is so pronounced as to threaten death; the senses are often more acute, but tinnitus and amaurosis may be present if the paroxysms are severe. The muscles of the jaw are generally the last in the body to become affected, but trismus finally comes on in severe cases. H. C. Wood has seen death occur in this first convulsion in animals, but Tardieu states that he knows of no such instance in man.

After a shorter or longer time muscular relaxation sets in and a period of calm ensues, to be succeeded by a second convulsion. The slightest noise, draught of air, or touch may cause a convulsion or series of convulsions, because the sensory impulse reaching the spinal cord causes a spasmodic motor impulse to be sent out to the muscles; a firm grasp or hard rubbing of the muscles is frequently grateful (Wood). During the spasms progressive asphyxia is present, the respiratory muscles being in a state of tetanic rigidity; during the periods of relaxation the patient breathes easily.

A slight rigidity is sometimes present during the periods of relaxation, but no marked stiffness. The cramp-like contraction of the muscles is generally, but not always, painful. Erections of the penis are not infrequent, and the urine and feces may be voided involuntarily. If the case is to terminate favorably the convulsions gradually lessen in severity and finally cease, leaving the patient exhausted, with a sore, tired feeling in the muscles from overcontraction. Death occurs either from cramp-asphyxia, or, more rarely, from exhaustion. Post-mortem examination reveals the usual



congestive lesions of death from asphyxia and, at times, indications of spinal hyperæmia (Wood).

Strychnine poisoning may be confounded with traumatic or hysterical tetanus. The convulsions of strychnine poisoning do not resemble those of epilepsy, as they are distinctly tonic and never clonic. In tetanus the locking of the jaws (trismus) comes first, in strychnine poisoning it comes last. The convulsions of tetanus rarely, if ever, completely relax; in strychnine poisoning periods of relaxation occur. In tetanus there is usually the history of an injury, or of a rusty nail or needle run into the foot or other part of the body.

The minimum fatal dose of strychnine is probably something under  $\frac{1}{2}$  grain (H. C. Wood). One one-hundredth of a grain is said to have killed a child  $3\frac{1}{2}$  months old. Ten, 20, and 22 grains, taken upon a full stomach and retained two hours, have failed to cause death in each case, probably on account of slow absorption (Wood).

#### *Treatment of Poisoning by Strychnine.*

—If no symptoms have appeared, inhalations of amyl-nitrite may be administered and the stomach washed out. The chemical antidotes—as tannic acid, iodine, or one of its soluble salts—may now be administered, but should be followed by a quickly-acting emetic or be removed by the stomach-tube, as the compounds formed by those substances are not permanent. Potassium bromide ( $\frac{1}{2}$  ounce) combined with chloral ( $\frac{1}{2}$  to 1 drachm) may at first be given, and every twenty minutes afterward, if necessary, 2 drachms of the bromide and 15 grains of chloral. The bromide and chloral are physiological antidotes, the former depressing the sensory tracts of the cord, the latter depressing the motor tracts. Artificial respiration is very valu-

able, but is seldom available in man. Other drugs are favorably mentioned as antidotes. Hydrastinine hydrochloride, given hypodermically, in the amount of 1 grain, has been successful. Nicotine has proved efficient in many cases; also tobacco by enema. Chloroform or amyl-nitrite, by inhalation, may be used to procure muscular relaxation, but they must obviously be used during the period of relaxation, as they cannot be utilized when the chest-muscles are in a state of severe tonic contraction. Veratrum viride has cured a bad case; a fluidrachm of the tincture was given at once, followed by 2 drops every ten minutes (Ringer).

Led by the accidental observation of the recovery of a dog from strychnine poisoning after eating about 4 ounces of lard, a series of thirteen experiments were made on dogs and other animals. In all cases, except the first two dogs (which died from 2 grains each of strychnine, with only 6 ounces of lard administered as an antidote, the last two, however, recovering from the same dose of strychnine after taking 12 ounces of lard), the animals recovered, although the lard was not administered until after convulsions had well set in. W. D. Turner (Indian Lancet, June 1, '98).

Case of a  $2\frac{1}{2}$ -year-old boy who swallowed strychnine, the quantity being unknown. Medical assistance reached him one hour later, but the convulsions became clonic, and death was imminent. One-twenty-fourth of a grain of hydrochloride of pilocarpine was then given, which was followed by a lessening of the convulsions, and after a second injection they ceased entirely, the patient making an uneventful recovery. J. D. Batson (Phila. Med. Jour., Apr. 18, 1903).

**Therapeutics.** — GASTRO - INTESTINAL DISORDERS.—In that condition popularly known as “torpid liver,” when the stools are pale in color and have an offensive odor, showing an absence of bile;

when the tongue is covered with a thick fur and the patient complains of headache, lassitude, loss of appetite, and a bad taste in the mouth, small doses ( $\frac{1}{60}$  grain) of strychnine given two or three times daily will often act as well as a mercurial, restoring the bile and correcting the other symptoms.

Great care should be taken in administering strychnine to patients who have arrived at the degenerative age, especially in cases of cirrhotic Bright's disease, chronic gout, and syphilis, or when a patient has thickened and tortuous blood-vessels, or even when there has been an hereditary tendency to apoplexy. L. Grant (*Lancet*, Apr. 28, 1900).

In the vomiting of phthisis strychnine is one of the best agents at our command.

Epidemic diarrhoea and dysentery are frequently controlled by strychnine.

In acute and chronic alcoholism strychnine is a valuable remedy. The administration of small doses will control the morning vomiting and dyspepsia, will check the tremor of chronic alcoholics in the forming stage of delirium tremens, and will remove the depression due to abstinence from alcoholics. The hypodermic injection of  $\frac{1}{30}$  to  $\frac{1}{20}$  grain, three or four times daily for a week, or possibly two, will remove the craving for stimulants and counteract the vasomotor paralysis to which the injurious effects of alcohol are due.

In constipation due to atony of the muscular coat of the bowel strychnine is beneficial when added to purgative pills.

**NERVOUS DISORDERS.**—Strychnine is valuable in functional nervous atony or depression, but is harmful in organic disease during the period of acute inflammation or in acute infantile palsy.

In acute or subacute neuritis the use of strychnine is harmful, as the nerves are already inflamed.

In progressive lead palsy large doses of strychnine will check the progress of the disease; potassium iodide taken concurrently will hasten the elimination of the lead.

Amaurosis due to the excessive use of alcohol or tobacco is particularly amenable to strychnine. Beginning with  $\frac{1}{40}$  grain, the dose may be gradually increased to  $\frac{1}{8}$  or  $\frac{1}{6}$  grain; improvement may not be apparent until the larger doses have been reached. Eye-strain from insufficiency of the ocular muscles may be relieved by strychnine. (See *NUX VOMICA*.)

After the occurrence of brain-lesions, strychnine may be employed to maintain the nutrition of the paralyzed limb; but, if palsy is due to a disease of the trophic cells of the cord, little benefit will result save the stimulation of the remaining cells. Used too early in cerebral paralysis, especially when due to hæmorrhage, it may do serious harm; and in the early stages of organic disease it may be decidedly harmful, especially in large doses.

In hemiplegia when degeneration has not set in and the paralyzed muscle is not completely relaxed, strychnine is an efficient remedy; it is of no avail in recent cases or when electrical contractility is lost. Strychnine should never be used during the presence of acute symptoms of congestion or inflammation of either the spinal cord or of its meninges.

In tremors and ataxic movements of various kinds (but not in locomotor ataxia), and also in chorea, epilepsy, and idiopathic tetanus strychnine will be found of value.

Strychnine is highly efficient in many forms of neuralgia, especially visceral (gastralgia, hepatalgia, etc.), and also in infra-orbital and other neuralgias ac-



companied anæmia and general debility, in all of which small doses ( $\frac{1}{100}$  grain) should be exhibited.

Hypodermic injections of very large doses of sulphate of strychnine are of value in *tic douloureux*. The injections, once a day, should begin with  $\frac{1}{30}$  grain and be rapidly increased to  $\frac{1}{5}$  or  $\frac{1}{4}$  grain. Usually the injections should be discontinued after five or six weeks' usage, but repetition may be required once or twice again. On discontinuing the strychnine, iodide of potassium, nitroglycerin, or other drugs should be ordered. Rest in bed with freedom from care are enjoined during treatment.

Dana (*Va. Med. Monthly*, May, 22, '96).

Local paralysis and diphtheritic paralyses are amenable to strychnine internally administered.

**PULMONARY DISORDERS.**—In pneumonia, and in other acute diseases, threatened collapse may be averted by hypodermic injections of strychnine ( $\frac{1}{30}$  to  $\frac{1}{4}$  grain); the beneficial effect will be improved by the addition of atropine sulphate ( $\frac{1}{150}$  to  $\frac{1}{100}$  grain) to each injection. Habershon (*St. Bartholomew Hosp. Reports*, '86), Kidd (*London Pract.*, Sept., '94), and Hare (*Ther. Gaz.*, Apr., '95) testify to the value of strychnine in pneumonia.

Dyspnœa from any cause—winter cough or bronchorrhœa in the aged, emphysema, and phthisis—is relieved by strychnine.

The value of strychnine in the treatment of phthisis has been fully set forth by Thomas J. Mays, of Philadelphia (*Jour. Amer. Med. Assoc.*, Oct. 10, '96; *N. Y. Med. Jour.*, Oct. 27, '96). He regards the state of the nervous system as an important factor in giving rise to pulmonary tuberculosis, and concludes that no drug compares favorably with strychnine in the treatment of this disease. He begins with  $\frac{1}{30}$  grain, given four times a day; give this for a week and increase it to  $\frac{1}{24}$  grain for another week; during

the next give  $\frac{1}{20}$  grain; the following week raise the dose to about  $\frac{1}{16}$  grain; and so on until the signs of beginning strychnine intoxication appear (usually when  $\frac{1}{12}$  or  $\frac{1}{8}$  grain is reached). The object is to impress the nervous system with the full stimulant effect of this drug, keeping the strychnine up to the highest level of safety, but shunning the point where its stimulus extends into the region of tetanus or paralysis. At this point he reduced the dose from  $\frac{1}{8}$  grain to  $\frac{1}{16}$  grain and then gradually increases it again, alternately. Given in this way the symptoms and general condition of the patient will improve in every way.

The plan personally pursued in giving strychnine is as follows: As a rule, 1 grain is divided into thirty or thirty-two doses, and one dose administered four times a day. This lasts one week, and the following week  $1\frac{1}{4}$  grains are divided and given in the same manner. After this, instead of increasing the drug a quarter of a grain, as in the first week, it is augmented to only an eighth of a grain every week until the line of toleration of the drug is approached. This is most often shown by slight twitching in a leg, by a tendency to stiffness of the lower jaw, or by a fullness in or drawing of the neck. After this a somewhat smaller dose is given for two weeks or a month, and then an effort is made to push it too near a point of physiological toleration; or a retreat is made to a point near the initial dose, and this is gradually increased until the line of toleration is again in sight. The dose is diminished and the previous steps are repeated again and again. Thomas J. Mays (*N. Y. Med. Jour.*, Oct. 8, '98).

**SURGICAL SHOCK.**—Strychnine is very valuable in the treatment of surgical shock. In severe cases as much as  $\frac{1}{4}$  grain may be given by hypodermic injection.

**ANTIDOTAL USES.**—Strychnine is a valuable antidote in poisoning by chloral, physostigma, and opium, in the latter

case being better than belladonna. It is also useful in all cases of narcotic poisoning, where respiratory failure is imminent or present. In chloroform poisoning the hypodermic injection of  $\frac{1}{10}$  grain is advised, and this to be repeated in ten minutes if no effect has been produced.

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**SULPHONAL.** — Sulphonal (sulfonal, di-ethyl-sulphone-di-methyl-methane) is obtained from anhydrous acetone by anhydrous ethyl-mercaptane with a stream of dry hydrochloric-acid gas. It occurs in thick, tasteless, odorless, colorless prisms, soluble in 65 parts of cold and in 2 parts of boiling alcohol, in 135 parts of ether, in 500 parts of cold and in 15 parts of boiling water. Sulphonal is not affected by any of the ordinary acids, alkalies, or oxidizing agents either in the cold or when warm, and is a very stable compound. This substance was introduced by E. Baumann in 1886, and clinically reported upon by A. Kast in 1888, as an hypnotic in doses of from 15 to 45 grains. On account of its insolubility and slow rate of absorption when given in capsules or suspended in mucilage or simple elixir, it has been suggested that it be administered in hot broth, coffee, or milk. Stewart suggests that at bed-time the sulphonal be completely dissolved in boiling water, and drunk as soon as it has been cooled to a temperature which can be borne, before precipitation occurs. This solution may be flavored with *crème de menthe*.

**Physiological Action.**—The symptoms produced by sulphonal in man by even large therapeutic doses are simply quiet sleep, without any disturbance of digestion, pulse, or temperature, out of which the patient wakes after some hours

in his normal condition, or occasionally with a certain amount of giddiness and lack of mental tone. It seems doubtful whether any single dose of sulphonal will cause death in the robust adult; certainly enormous doses have been taken and survived (Wood). Kast affirms that the blood-pressure is not altered by doses which produce sleep, and in the experiment of William F. Shick, of Easton, Pa., there was even pronounced rise of the arterial pressure, the cause of which was not determined; as no experiments were made upon curarized animals, the rise in the blood-pressure may have been produced by the failure of respiration (Wood). Shick states that sulphonal in moderate doses produced relaxation of the muscles and a staggering gait, but had no influence upon the motor or sensory nerves nor upon the muscles.

The reflex activity is markedly diminished by sulphonal, which is probably a direct depressant to the spinal cord; but Shick states that in some of his experiments the reflex activity was increased, and that the decline of the reflexes is, in fact, due to stimulation of Setschenow's centre. Kast found neither microscopical nor spectroscopical blood-changes in animals acutely poisoned by sulphonal. When taken in large amount, sulphonal is eliminated, in part by the kidneys unchanged, but the greater portion of it appears to be eliminated, according to Smith, of London (London Pract., Jan., '89), in the form of an organic sulphur compound, probably ethyl-sulphonic acid. The same experimenter found that moderate doses increased the amount of urea and the quantity of urine excreted, but to so slight a degree that it does not appear that in such doses the destruction of nitrogenous tissue is materially affected. The phosphates in the urine are said by



some observers to be increased by small and decreased by large doses of this drug. The color of the urine is apt to be changed to a reddish brown by the presence of a coloring matter which is closely allied to and has been generally supposed to be identical with hæmatoporphyrin. The two substances are identical by almost every test, but the spectroscope reveals a difference.

W. Morro (*Deut. med. Woch.*, No. 34, '94) concludes from experiments that sulphonal is not destroyed in the organism, but is eliminated in the urine, from which it can be separated in a crystalline condition. The quantity eliminated increases day by day while it is being administered, and, in general, if its use be discontinued, three days must elapse before the sulphonal accumulated in the body will be eliminated.

This drug, therefore, has a cumulative and prolonged action. It would seem that sulphonal chiefly, if not wholly, affects the cerebral centres, and a large number of the symptoms produced—such as somnolence, stupor, disinclination to mental or physical effort, muscular weakness, inco-ordination and paresis, diplopia, aphasia, and slow and weak respiration and pulse—may be explained by the theory that the irritability of the central nervous system is obtunded by its action (M. L. Foster).

**Poisoning by Sulphonal.**—Disagreeable after-effects have followed the use of sulphonal in ordinary therapeutic doses. In the report of the Therapeutic Committee appointed by the British Medical Association to investigate the utility of various hypnotics these untoward effects are summarized as follows:—

“In 6 out of 10 cases in which 20 grains had been given disagreeable after-effects were noted: drowsiness next day was noted 6 times, giddiness 4 times, and

headache and inco-ordination of gait each twice. In 4 cases where 10 grains has been given drowsiness was noticed once; in 5 cases with 15 grains drowsiness was noticed twice and giddiness twice; with 25 grains (4 cases) drowsiness was noticed twice, giddiness once, headache once. In 7 cases with 30 to 60 grains drowsiness was noticed 4 times, giddiness twice, inco-ordination of gait and vomiting each once.”

Although sulphonal is claimed by many to be an absolutely safe hypnotic, there are numerous cases of death on record, some as the result of moderate doses. The most striking of these, perhaps, is reported by Pettit (*Med. News*, Aug. 10, '89). A woman, 28 years old, suffering from melancholia and hysterical manifestations, but not known to have any organic disease, took 30 grains of sulphonal in two equal doses, an hour and a quarter apart. She slept for 12 hours and then could be roused and could swallow, but somnolence increased for the next 12 hours. The pupils began to contract 18 hours after the last dose. At the end of 40 hours the temperature began to rise, and the patient died in spite of active treatment.

Rehm (*Berl. klin. Woch.*, No. 16, '89) reports a case in which a patient narrowly escaped death as the result of taking 18 grains for three successive days. Reinfuss (*Wiener med. Blatt.*, Jan. 7, '92), Stern (*Wiener med. Woch.*, No. 10, '94), Herting (*Allg. Zeit. f. Psych.*, B. 51, H. 1, '94), and others report fatal cases. The cases of Stern and Herting were instances of chronic poisoning; they had been under treatment for some time, and has been apparently benefited by the drug up to the time of the appearance of the toxic symptoms.

The recorded cases of sulphonal poisoning have been in women for the most

part. Among twenty-one cases, Schulz found that twenty were in women, and all observers have found that the victims of sulphonal poisoning were anæmic to a certain degree. The inference seems reasonable that certain conditions of the blood, such as chlorosis, have a direct connection with the supervention of toxic phenomena under the use of sulphonal. Pollitz (*Wiener klin. Woch.*, June 9, '98).

Since the drug was introduced by Kast in 1888, 30 fatal cases and about 50 non-fatal severe cases have been described, all chronic in character, and mostly in lunatic asylums. The amount necessary to cause poisoning varies extremely—1500 grammes in 6 years, 224 grammes in 205 days, 893 grammes in 971 days, 128 grammes in 91 days, and similar amounts have frequently been taken without any ill effects. On the other hand, death has occurred after 16 grammes in one month and 90 grammes in three months, and severe poisoning after 180 grammes in 270 days, 132 grammes in 120 days, and so on. Poisoning, therefore, does not depend directly on the amount taken, but probably to a large extent on the circumstances of the individual. Women are more commonly affected than men, and poor diet, age, and debility all increase the tendency. Constipation specially favors poisoning. Sulphonal should never be given continuously, and its administration should be interrupted every five to seven days or thereabouts. Dietrich (*Ther. Monats.*, Apr., 1900).

The various symptoms of sulphonal poisoning, though all are not usually present in any one case, are: drowsiness, stupor, muscular inco-ordination, incapacity for physical or mental exertion, tinnitus aurium, headache, vertigo, partial loss of the reflexes, nausea, vomiting, constipation, sometimes diarrhœa, ataxic nervous troubles, diplopia, muscular tremor or paresis, ptosis, œdema of the eyelids, slow and weak (possibly stertorous) respiration, slow pulse, elevation of temperature, general anæsthesia, reddish-brown urine, urine diminished or

suppressed, aphasia, and cyanosis. Death results from failure of respiration preceded by deep unconsciousness. In several fatal cases motor paralysis appeared to be the most prominent symptom (Foster).

*Treatment of Poisoning by Sulphonal.*—Recovery is usually most rapid in the non-fatal cases of poisoning, if the patient is thoroughly purged (Foster). Great good has seemed to have been produced by the free use of warm water, which should be given as largely as can be taken by the mouth, and also by injection into the rectum, with the hope of flushing the kidneys and aiding them in throwing off the poison (H. C. Wood).

The most important point in the treatment of poisoning from the disulphones is the prophylaxis. It is not an uncommon practice for the sick woman to be given a prescription for sulphonal to be taken at her own discretion, the doctor, perhaps, not seeing the patient for several weeks at a time. Such a course seems most reprehensible, considering the insidiousness of the onset of the intoxication and the fatal results when once the poisoning is established.

Another important precaution to be adopted is to see that the poison is not allowed to accumulate in the body. Simply stopping the remedy for a few days will not suffice. The interruption should be for at least one week, and the intestinal canal should be thoroughly cleared out. In chronic sulphonal poisoning after the discovery of the trouble the poison is to be stopped immediately and absolutely; if an hypnotic is necessary, morphine, combined with hyoscine, or small doses of chloral may be given. The first thing to be done is to empty the bowels thoroughly and promptly. The importance of this cannot be too strongly insisted on.

After emptying the bowels the most promising treatment of disulphone intoxication is that of Müller. Sodium bicarbonate formed the chief reliance of this investigator; but any other antacid,



as magnesium carbonate, may be employed. Large amounts of water should be introduced into the circulation, both by the intestinal tract and by the subdermal tissues, in order to aid the elimination of the poison. The convalescence is likely to be very slow, often lasting several months. H. C. Wood, Jr. (Merck's Archives, Nov., '99).

**Therapeutics.**—Sulphonal is a powerful hypnotic, having little or no analgesic effects and ranking below chloral in power and certainty of action and above paraldehyde. It will sometimes succeed when the other hypnotics fail.

In functional nervous insomnia sulphonal is valuable as an hypnotic except when the presence of advanced organic disease of the heart is the cause of the wakefulness, in which case it is dangerous. When sleeplessness is due to pain, sulphonal is generally useless. In the insomnia of insanity it generally acts well, producing sleep by night and quietness during the day.

Sulphonal has been suggested as a remedy in epilepsy, hiccough, chorea, and nocturnal cramps on account of its action upon the reflexes.

In phthisis 8 grains of sulphonal are said to prevent night-sweats as effectively as atropine, and to exert this effect for a longer time.

In diabetes it has been found to cause a diminution of the sugar in the urine; but the effect is only temporary, as the sugar reappears upon the withdrawal of the drug.

Bad results have followed the use of sulphonal in angina pectoris; it is contra-indicated in that disease, and also when there is any congestion or inflammation of the kidneys.

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**SULPHUR.**—Sulphur is a non-metallic, solid element found native in the

western United States, Mexico, Iceland, and in the West Indies, but more abundantly in Sicily and Italy, whence the commercial supply chiefly comes. It is widely distributed in nature, in the neighborhood of extinct volcanoes and in combination with metallic bases as sulphides, especially copper and iron pyrites. It is an important constituent of certain native mineral springs which furnish sulphurated waters. When fused and cast into rolls or cylinders it is popularly known as brimstone. As it occurs in nature, it forms yellow, transparent, rhombic crystals. Sulphur emits a peculiar odor when rubbed, and has a very faint taste. It is insoluble in water, but soluble in benzin, benzene (benzol), turpentine, ether, chloroform, carbon disulphide, the fixed and volatile oils, and in boiling alkaline solutions. Sulphur should never be triturated with any chlorate, as they form an explosive mixture.

Sulphur *per se* is official in three forms: sublimed, precipitated, and washed sulphur. The iodide (containing 20 per cent. of washed sulphur and 80 per cent. of iodine), crude sulphurated lime, and sulphurated potash are also official.

Washed sulphur (sulphur lotum, U. S. P.) occurs as a fine, yellow, dry powder, without odor or taste.

Precipitated sulphur (lac sulphuris, or milk of sulphur; sulphur præcipitatum, U. S. P.) occurs as a fine, amorphous, pale-yellow powder.

Sublimed sulphur (flowers of sulphur; sulphur sublimatum, U. S. P.) occurs as a fine, yellow powder, having a faint odor.

Iodide of sulphur (sulphur subiodide; sulphuris iodidum, U. S. P.) occurs in grayish-black masses, having a metallic lustre and the odor of iodine. It is solu-

ble in carbon disulphide, and in 60 parts of glycerin. It should be kept cool and in glass-stoppered bottles.

Sulphurated lime (calcic liver of sulphur; liver of lime; calx sulphurata, U. S. P.) occurs as a grayish-white powder, having the odor of sulphurated hydrogen, and an unpleasant alkaline taste. It is soluble in glycerin, and in boiling water with partial decomposition.

Sulphurated potash (so-called "potassium sulphide; liver of sulphur; potassa sulphurata, U. S. P.) occurs as a hard, brittle, brownish substance, having a faint, sulphurated-hydrogen odor, and a bitter, alkaline taste. It is soluble in 2 parts of water, and is incompatible with acids, alcohol, etc. Even carbon dioxide precipitates sulphur from it in solution.

**Preparations and Doses.**—Sulphur lotum (U. S. P.), 15 to 90 grains.

Pulvis glycyrrhizæ comp. (U. S. P.),  $\frac{1}{2}$  to 2 drachms. (See LICORICE.)

Unguentum sulphuris, U. S. P. (washed sulphur, 30 per cent.).

Sulphur præcipitatum (U. S. P.), 15 to 90 grains.

Sulphur sublimatum (U. S. P.), 1 to 3 drachms.

Sulphuris iodidum (U. S. P.), 1 to 4 grains.

Calx sulphurata (U. S. P.),  $\frac{1}{10}$  to 1 grain. (See CALCIUM.)

Potassa sulphurata (U. S. P.),  $\frac{1}{2}$  to 5 grains.

**Physiological Action.**—Sulphur has little or no effect when applied locally, but combination with fats, as in ointment, makes it at once active; inflammation of the skin may follow its continued use in concentrated form. Taken internally it is dissolved by the alkaline intestinal juices, to some extent, and absorbed. It has been detected in the milk, sweat, urine, and even the breath

of persons taking it. It is supposed to undergo oxidation in the system. In sufficient quantity, sulphur acts as a mild laxative, producing soft, semiliquid, feculent stools, accompanied with considerable sulphurated-hydrogen gas. Its continued use has probably an effect upon nutrition: the secretions generally are increased. It appears to have an especial action upon the skin and mucous membranes.

**Poisoning by Sulphur.**—Poisoning by this drug is rare, but poisonous effects have been observed from the ingestion and from the external use of sulphur. The symptoms of poisoning are nausea, dysentery, tonic contraction of the muscles of the extremities, the appearance of fever, and painful urination. In one case there was extreme prostration, a sulphurous breath, clammy perspiration, vomiting and purging, and intestinal colic. Such symptoms of irritant poisoning are due, without doubt, to the presence in the sulphur of a large quantity of sulphuric acid (H. C. Wood). The treatment of such poisoning would be that of poisoning by sulphuric acid: the administration of chalk, magnesia or soap with demulcent drinks, and opium to allay pain and control peristalsis.

**Therapeutics.**—**GASTRO-INTESTINAL DISEASES.**—Sulphur has been used as a laxative in cases of hæmorrhoids and intestinal obstruction on account of the pulpy, soft stools which it induces. It is also a favorite laxative in cases of chronic rheumatism.

In diarrhœa with offensive watery stools of scrofulous children and in dysenteric diarrhœa, minute doses of sulphur have been beneficial.

In disordered or suspended hepatic function sulphur, in doses of 5 to 20 grains, has restored that function.

Biliary colic due to impacted gall-



stones has been relieved by daily doses of 5 grains.

**LITHÆMIC DISORDERS.**—Sulphur has been used largely in the treatment of rheumatism and gout. In lumbago and sciatica the flowers of sulphur may be applied to the affected part, retained by a suitable bandage. It may also be applied as a thick paste for the relief of sciatica, as suggested by de Mussy; one night's use generally suffices. In muscular rheumatism small doses of sulphur are advised, in conjunction with iodine or arsenic.

**RESPIRATORY DISORDERS.**—Insufflations of powdered sulphur have been advised as an efficient remedy in croup.

Chronic bronchitis, in many cases, is amenable to sulphur. G. Sée recommends the following: Precipitated sulphur, 50 grains; extract of belladonna-leaves, 1 grain; Dover's powder, 5 grains; sugar, 20 grains; to be dispensed in ten capsules, two to ten being taken daily as required.

The following are indications for the use of sulphur-waters: 1. Chronic catarrh of the respiratory organs, dependent more upon venous hyperæmia and unaccompanied by any special complication. 2. Circulatory disturbances in the abdomen and the gastric and intestinal disorders evoked by them. 3. Various exudative processes in joints, muscles, and bones, defective callous formation after fractures, chronic periostitis, caries, and necrosis, callous ulcers, tendo-vaginitis, and deficient mobility after various injuries in which surgical interference is not indicated. 4. Chronic phlebitis, periphlebitis, and inflammations of the skin. 5. Various forms of chronic rheumatism, gout, and rheumatic and nervous paralyses. 6. Metallic poisoning, especially by lead and mercury, and its after-effects. 7. Syphilis, sciatica, and neuralgia. Partes (Wien. med. Presse, No. 49, '97).

In diphtheria insufflations of sulphur have been used with apparent benefit.

Sulphur dioxide easily kills the diphtheria bacillus whether in a dry or moist condition, but it is not to be relied upon for more resistant organisms. F. J. Allan (Treatment, Sept. 8, '98).

**CUTANEOUS DISORDERS.**—In scabies sulphur ointment is one of the best remedies. It should be well rubbed into the affected parts, after previous scrubbing with soap and hot water.

Sulphur-waters are useful externally in scabies, acne, furunculosis, and hyperidrosis; internally, to stimulate the glands of the alimentary canal and to increase the biliary secretion. They are especially indicated in so-called abdominal plethora, hyperæmia of the liver and chronic gout, in rheumatism, rheumatoid arthritis and chronic catarrhal conditions of the alimentary canal, the bronchi, and the throat. W. Page May (Practitioner, Nov., '98).

In tinea tonsurans sulphur ointment is efficient after clipping the hair.

Seborrhœa, sycosis, chronic eczema, and psoriasis are benefited by small doses of sulphur. Inveterate forms of eczema, psoriasis, impetigo, and prurigo are improved by the fumes of burning sulphur.

In erysipelas, measles, and small-pox sulphur ointment will allay the heat and congestion and in small-pox will disinfect the pustules.

In diseases of the nails, when they have become brittle, and covered with ridges and white spots, internal use of sulphur in small doses will frequently bring about a healthy and polished appearance.

Sulphur in small doses will often increase the activity of the hair-forming apparatus in cases of alopecia.

In skin diseases accompanied with infiltration the use of the iodide in a 6-per-cent. ointment is indicated.

In scaly skin diseases, sulphurated potassa is useful, 1 to 3 ounces being dissolved in 15 gallons of water, for a bath.

In suppurative diseases, in acne, boils,

glandular enlargements, etc., calx sulphurata in small doses will do good.

In young women who suffer from acne, particularly about the menstrual period, the skin becoming at this period sallow and muddy, Ringer recommends the following lotion as one which is usually curative: Sublimed sulphur, 1 drachm; glycerin, 1 drachm; rose-water, 8 ounces; apply as a wash once or twice daily.

**CHLOROSIS.**—In chlorosis when iron is not well borne or has failed, sulphur has in many cases improved the general condition, so that iron could be used with success later.

**FUMIGATION.**—The antizymotic and antiseptic properties of sulphur have been long known. When sulphur is ignited it gives off dense fumes of sulphurous-acid gas, which are known for their bactericidal action. The fumes of sulphur dioxide destroy the germs of cholera, typhoid fever, diphtheria, glanders, and tuberculosis. The disinfecting qualities of this gas have been utilized by sanitary authorities to disinfect rooms that have been occupied by patients suffering from infectious or contagious diseases. Prolonged action of the pure gas may destroy germs even in a dry atmosphere, but the presence of moisture increases its efficacy. Three pounds of sulphur, moistened with alcohol, should be laid in a pan which rests on a support in a tub of water to prevent fire. Infected ships may be treated in the same way.

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**SUPRARENAL CAPSULES, DISEASES OF.**—The disorders of these organs other than Addison's disease have, as yet, received but little attention.

Hæmorrhage into the suprarenal cap-

sules may occur in the course of infectious diseases.

It is also observed in newborn children.

Tuberculosis of these organs is not uncommon as a complication of tuberculous disease elsewhere in the organism. (See ADDISON'S DISEASE, volume i.)

**Tumors.**—Yellowish adenomata are often observed in these organs; fibromata and lipomata occasionally.

Malignant tumors are rarely observed, but, as recently shown by Ramsay (Bull. Johns Hopkins Hosp., Jan.-Mar., '99), after a study of sixty-seven cases, they should be borne in mind in the presence of an abdominal tumor.

**SYMPTOMS AND DIAGNOSIS.**—The main symptoms of malignant growths are rapid loss of strength, debility, emaciation, digestive disorders, and abdominal pain, with skin-changes in some cases. These are fairly distinct in some cases; in others no symptoms point to a suprarenal origin. A differential diagnosis must be made from other suprarenal diseases, renal and hepatic tumors, diseased retroperitoneal glands, and cysts and growths of the pancreas. The prognosis is always serious.

The symptoms of malignant neoplasm of the suprarenal gland in some respects suggests Addison's disease, but the resemblance is not marked, and the skin-changes and disturbances of the circulatory system are generally absent. Tuberculosis, the writer believes, with Leva, is more apt to involve the sympathetic; hence more apt to cause bronzing. The most frequent symptom (only 37 cases were available for study in this respect) was marked and progressive loss of strength—seen in 22 patients—accompanied in many by extreme languor and debility. Emaciation was present in 20. In 12 cases out of the 37 nausea and vomiting occurred; in 9 there was loss of appetite, diarrhœa in 4, and constipation in 5. The circulatory system was



rarely involved. Though there was extension of the growth in the vena cava and thrombosis in 4 or 5 cases, they did not suffer from œdema. Pain existed in 25 cases; in some it was referred to the renal regions behind; in others it occupied the whole back; in some it was in the epigastrium or hypochondrium. Three out of the 37 showed distinct bronzing of the skin; in 2 there was a peculiar profuse growth of hair. The temperature was usually normal, and not, as Berdach has claimed, subnormal. In 13 out of the 37 cases the growth caused no symptoms referable to the suprarenal. O. Ramsay (Bull. Johns Hopkins Hosp., Jan., Feb., Mar., '99).

**ETIOLOGY AND PATHOLOGY.**—According to Rolleston (Amer. Jour. Med. Sci., Oct., '98), the anatomical characters of malignant growths are often hæmorrhagic, with a tendency to break down in the centre and form a pseudocyst. Sarcoma is the more frequent form, having been present in fifteen of twenty-four cases studied by him. Men are somewhat more frequently affected than women (Ramsay).

**TREATMENT.**—Operative procedures proved successful in two of Ramsay's cases, the principal difficulties met with being the friability of the tumor, the great tendency to hæmorrhage, and the frequency of adhesions.

## SURGICAL DISEASES.

**Traumatic Fevers.**—Traumatic fever is a term applied to those constitutional disturbances which accompany the process of healing and which are dependent upon the nature of the changes taking place in the wound. If there be an absence of suppuration (primary union), the term *primary wound fever* is applied; if suppuration be present (healing by granulation), the disturbance is called *secondary wound fever*.

**Primary Wound Fever.**—Two types of primary wound fever are observed: (1)

*aseptic fever*, and (2) *traumatic*, or *surgical fever*.

**ASEPTIC FEVER.**—In the healing of aseptic wounds there is an absence of inflammation. There is, however, a slight febrile movement, the temperature rising 3 or 4 degrees above normal and not returning again for a period of from two to four days.

There are but few symptoms, other than the febrile movement, in this variety of fever. There is usually an absence of malaise and delirium. The patients feel well and are able to sit up or be about the room.

Aseptic fever may be present during the healing of simple fractures, in undrained wounds, and all wounds—large or small—which heal by first intention. It is believed to be caused by the absorption of pyogenic substances derived from the broken-down tissue and blood-clot, which latter contains a substance known as fibrin-ferment. Fibrin-ferment causes a general coagulation of blood in the vessels and death, when injected into animals.

Aseptic fever calls for no treatment, as it is of short duration and of slight severity.

**TRAUMATIC, OR SURGICAL, FEVER.**—This fever was well known before the advent of the antiseptic treatment of wounds, as more or less inflammation was considered as one of the necessary features of normal wound-healing even in the absence of suppuration. It may be observed during the healing of wounds which have not received antiseptic treatment, especially where the wound is the result of an injury or is the seat of septic infection.

**Symptoms.**—The constitutional symptoms depend largely upon the condition of the wound and upon the degree and extent of the inflammation. A marked

rise of temperature may be observed in twenty-four to forty-eight hours after operation or injury, accompanied by a rapid pulse; hot, dry skin; furred tongue; scanty, high-colored urine; and, at times, a mild delirium. The patient usually feels very warm and restless and complains of great thirst. The thermometer will usually indicate a temperature of 102° F., or more, on the evening of the second day. The following morning the temperature will be slightly lower, but by evening it will have risen as high as, or higher than, on the preceding night. On the third or fourth day suppuration is established, and the wound becomes clean and filled with granulations, which prevent the absorption of the pyogenic or fever-producing substances, and thus causes the temperature to decline. The other symptoms disappear with the decline in temperature. The duration of traumatic or surgical fever is from seven to ten days.

*Etiology.*—This form is believed to be due to the absorption of ptomaines which result from a fermentative process induced by the presence of bacteria in the secretions of the wound. Very few, if any, bacteria are found in the blood during this fever. When free discharge is established in the wound, the ptomaines are no longer absorbed, the temperature falls, and the symptoms improve. Septic inflammation may result from the infection of retained secretions, from the growth of bacteria in the track of one or more sutures forming a stitch-abscess, or from too great tension upon the lips of the wound.

*Treatment.*—A high temperature associated with the other symptoms of fever should lead to the examination of the wound, as to its condition and the presence or absence of bacterial infection. All infected areas should be evacuated,

and infected stitches removed. If much inflammation be present and the lips of the wound are red, swelled, and tender, the wound should be cleansed with an antiseptic solution (peroxide of hydrogen, sublimate, etc.), and drainage-tubes inserted, or be reopened and moist antiseptic dressings applied. The condition of each wound will determine the amount of interference necessary. The administration of nervous sedatives or opiates may be required for the relief of pain and insomnia.

**Secondary Wound Fever.**—This form of fever, sometimes called suppurative fever, occurs after suppuration is established, and is more marked when there is greater or less retention of the pus.

**SYMPTOMS.**—The constitutional disturbance, when suppuration takes place in a wound, is usually profound. There is a sudden and marked rise of temperature which may be preceded by a chill. If the abscess is confined to the wound, the pus may be easily liberated; but, if infection of the surrounding connective tissue has occurred, the pus may burrow in various directions, usually along the lines of least resistance, which will necessitate the making of a number of counter-openings in order to check the suppuration. The inflammation may become subacute, or chronic, and continue for many weeks. In this case the fever becomes remittent in character, with evening rise and morning fall to normal, like hectic fever, which is a suppuration fever accompanying tuberculosis. Marked prostration, with weak, rapid pulse, and emaciation are present if the suppurative fever continue long. Diarrhoea and night-sweats are often present; septic poisoning or exhaustion may lead to a fatal issue unless the suppuration is checked. If the type be more chronic (lasting for months), emaciation will be



more gradual, and amyloid degeneration of the kidneys, liver, and other internal organs, and enlargement of the lymphatic glands may take place.

**DIAGNOSIS.**—If the temperature does not fall at the end of a few days after the beginning of the healing process, but remains high or ascends higher, it may be assumed that pus has formed in the wound.

**ETIOLOGY.**—This fever is due to the absorption of ptomaines, or a chemical poison, developed as a result of a fermentation induced by the presence of pyogenic bacteria. The bacteria are not always to be found in the blood or tissues, and a decline of the temperature immediately follows the evacuation of the pus. There is no progressive infection of the system, as in pyæmia.

**PROGNOSIS.**—The prognosis is generally favorable except when the fever is associated with tuberculosis, in which case it is very unfavorable.

**TREATMENT.**—In acute suppuration, evacuation of the pus, thorough disinfection of the wound and all tracks of suppuration, and the complete removal of infected granulations by means of the curette are indicated. Where joints are involved, resection must be considered, except when amyloid degeneration of the kidney is present (shown by examination of the urine), in which cases amputation may offer a chance for prolonging the life. In all cases a nutritious diet and a liberal use of stimulants are especially needed. Fresh air, and plenty of it, is a great restorative. If the weather permit, the patient may be placed in a tent or out in the open air with great advantage.

**Traumatic Delirium.**—This term is applied to those forms of delirium which occur as the result of injury, and are not due to alcoholism, pyrexia, or the effects of anæsthesia.

**SYMPTOMS.**—This condition is usually marked by some præcordial distress, accompanied by oppressed and sighing respiration. The pulse is soft and compressible, but exceedingly rapid and bounding. The face is flushed. The tongue is moist and tremulous, and the skin is moist. There may be vomiting. The principal feature of this condition, however, is a peculiar delirium, very closely resembling that of delirium tremens; and in many cases the resemblance is so close that it is often quite impossible to draw the line between the two conditions. There are the same brightness of the eye, heat of the head, constant and irrepressible muscular action, and sleeplessness with wandering delirium and rapid succession of spectral delusions, usually of a frightful and painful character (Ashhurst). In some cases the delirium is of a mild character, the patient being haunted with extravagant ideas; in other cases the patient tries to get out of bed, and attempts to injure his attendants and soon becomes furiously maniacal (Druitt).

**DIAGNOSIS.**—This condition resembles in many points the effect of pyæmia, and cannot always be distinguished from it; fortunately the treatment of both is similar. Its resemblance to delirium tremens has been noted.

**ETIOLOGY.**—This condition is most frequently seen in persons of middle age and intemperate habits, and in children after capital operations. In severe traumatic fever delirium may be present. Severe burns, scalds, facial erysipelas, and cerebral lesions are liable to be accompanied by delirium. The seat of delirium is in the cortical gray matter of the brain. In some cases the delirium is caused by cerebral anæmia due to loss of blood.

**PROGNOSIS.**—The prognosis will be very unfavorable if the excitement is

violent, as that soon leads to coma and death. If the pulse becomes more tranquil and firm, there will be some hope, especially if the patient sleeps. It sometimes happens that the mental disturbance becomes permanent.

**TREATMENT.**—The indications are to lessen the excitement, promote sleep, and support the vital powers. All local sources of irritation should be removed, ice applied to the head, and bromides and hypnotics administered. If the delirium is due to cerebral anæmia from loss of blood, stimulants may be freely given. Opium, generally not well borne, should be given in repeated small doses ( $\frac{1}{4}$  to  $\frac{1}{2}$  grain every hour or two), if at all, especially if the restlessness and debility are very great; a large single dose (2 to 3 grains) may be required, and should be reserved for violent cases not amenable to other means. Beef-tea, milk, and other fluid nourishment may be given. Alcoholics may be freely given if the patient is an habitual drunkard. Mild aperients are often indicated. In mild cases the symptoms will subside in a day or two, if a moderate supply of stimulants be given.

**Malignant Œdema.**—This condition—known also as “gangrenous emphysema,” “*gangrène gazeuse*,” and “*gangrène foudroyante*”—is a rapidly-spreading gangrenous inflammation characterized by a distension of the affected tissues with the gaseous products of decomposition, due to infection by a special micro-organism. (See WOUNDS [SEPTIC] AND GANGRENE.)

## SYPHILIS.

**Etiology and Symptoms.**—Syphilis is due to the inoculation of a healthy individual with the secretion of a syphilitic subject or syphilitic blood. The disease is most usually transmitted during sexual congress, but is quite frequently con-

tracted in other ways. The conditions for inoculation are such that the disease may be transmitted extragenitally with great facility. It occurs through contact of the infectious principle of syphilis with a surface in a healthy individual from which the epidermis has been removed. The removal of the epidermis is essential, because the syphilitic infection has no corrosive properties *per se*.

Clinical experiences that apparently disprove this assertion are explicable by certain additional factors attendant upon the exposure to syphilitic infection; thus if the syphilitic infection be associated with another type of infection which possesses specially corrosive properties, the epithelium may be destroyed by the latter, this facilitating the absorption of the former. Uncleanliness favors the maceration and removal of epithelium, and if, under these conditions, a syphilitic secretion be brought into contact with the part, the epithelium may be removed by causes entirely independent of the syphilitic infection, after which the latter takes effect. When the syphilitic infection is associated with chancroid—the most corrosive of the venereal infections—the absorption of the syphilitic virus is greatly facilitated. Whether there is any antagonism between the chancroidal infection and that of syphilis sufficient to offset the favoring action of the corrosive property of chancroid in the absorption of syphilis is open to question.

It is obvious that indiscriminate sexual congress is the most potent predisposing cause of syphilitic infection. Uncleanly habits and local circumstances favoring the retention of secretions, physiological or pathological, are important predisposing causes. When the local circumstances favor a development of extreme sensitiveness and a tendency to abrasion of the epithelium under slight causes, the



predisposition to infection is greatly enhanced. Extreme length of prepuce in the male and the labia in the female are important predisposing causes. Alcoholism is an important predisposing cause, for two reasons: first, because it tends to produce irritability of the mucous membranes of the sexual organs; secondly, because of its tendency to produce moral obliquity and indifference as to results on the part of those who indulge to excess. In many instances individuals while under the influence of alcohol contract syphilis from sexual exposure which would be abhorrent to the patient when in his or her normal condition.

Six cases of syphilis, in five of which the infection is attributed to wounds from dental instruments, and in the sixth case to an instrument (tonsillotome) in the hands of a physician who never boiled his instruments. W. L. Baum (Jour. Amer. Med. Assoc., Jan. 27, 1900).

The immediate cause of syphilis is infection by a peculiar morbid principle contained in syphilitic blood or the secretion of the syphilitic lesion. This principle, although it has never been positively demonstrated, is now quite generally believed to be a germ.

**Incubation Period of Syphilis.**—After the poison of syphilis has been absorbed a certain period elapses before its morbid effects become manifest. This period lasts, upon the average, about twenty-one days, but varies considerably from this in different cases. Fournier relates a case in which the period was seventy-five days; Guérin, one of seventy-five days; and the writer has noted a case of seventy days. Instead of being prolonged, the period may be shorter than usual; thus, Hammond relates one of three days, and Dr. Nott, of New York, since deceased, reported his own case as developing within twenty-four hours after wounding his finger in operating

upon a syphilitic subject. Taylor reports a case in which the initial lesion appeared upon the second day, induration upon the fourth day, and general symptoms during the sixth week. It may, however, be accepted, as a practical rule, that true chancre does not appear before the tenth day. Any sore appearing prior to that time is probably chancroid or some simple affection, while any appearing later is quite likely to prove true chancre.

**Bacillus of Syphilis.**—The first investigator whose labors received any particular attention was Lustgarten, who claimed to have discovered in microscopical sections of chancre and syphiloma bacilli characterized by their color, reaction, form, and relative position. These bacilli he described as slim, straight, or somewhat curved little rods, closely resembling tubercle bacilli. He claimed that by his method of coloring he could differentiate the bacilli of syphilis from those of lepra and tuberculosis especially, and from all other known pathogenic bacteria. The bacillus of Lustgarten, according to its discoverer, acts by incorporating itself with the white blood-corpuscles. Neisser favors the bacillus theory of syphilis. Ehrlich and Birch-Hirschfeld also advocate it. Klebs, Aufrecht, Bergmann, and, following them, Bardozi, assert the existence of a peculiar micrococcus in the lymphatic glands and vessels of syphilitics.

Pure culture of micro-organisms personally obtained from syphilitic tissue, and especially from the blood, which, when inoculated into animals, presented a reaction to human syphilis. When these cultures were injected into the veins of pigs, or inserted subcutaneously, there developed at the point of injection a hard inactive sore, and eight or ten days after the injection there appeared on the skin of the animal numerous bright-red spots, which disappeared after about a week. Rabbits developed at the site of injection similar

hard sores. Two of these rabbits were paired, and the female gave birth to a litter of seven, all dead, and two of them, being macerated, greatly resembled in this respect syphilitic human embryos. The cultures were obtained especially from the marrow and epiphyseal lines of the bones of children who had died from hereditary syphilis. The material was preserved in bouillon, and then grown in various media. In almost every instance there was found a variety of streptobacilli or streptococci which had been previously obtained from the blood of patients suffering from dementia paralytica and tabes syphilitica. The bacilli can best be obtained from the blood, after the administration of mercury for a short time during the tertiary period. In the secondary period less success was secured in obtaining germs from the blood, which was thought to be due to the fact that at this period they lie chiefly in the skin. Von Niessen (*Centralb. f. innere Med.*, May 7, '98).

The blood of 125 syphilitics examined and the examinations checked by Professor Paltauf, who indorsed conclusion that the organism described is perhaps the specific germ of syphilis.

Even during the first four or five weeks changes cannot be noticed in recently infected individuals. When the disease is progressing the lymphatic glands are swelling and the general condition of the patient is growing worse; the bodies often appear in the blood before the exanthema is developed. This statement is of essential importance.

If a fresh drop of blood is placed on a sterilized slide, covered with a sterilized glass, and examined with  $\frac{1}{12}$  immersion Zeiss or Reichert and an ocular No. IV, there are found in the parts of the specimen which do not contain red blood-corpuscles long oval bodies about the size of the large, or acidophile, granules of the so-called eosinophile-leucocytes, but less glistening. These bodies can often be found immediately, but usually they do not appear earlier than after from two to three hours. At first they are mostly situated within the meshes of the fibrinous net-work and do not move. Later on they show a movement

and form chains of 2 or 4. After eight hours from 6 to 10 bodies may be present in one chain, and it is not uncommon, if the investigation started in the morning is interrupted by the night, that from 12 to 20 bodies form one chain. V. Neudorfer (*St. Paul Med. Jour.*, July, 1900).

Isolation of a characteristic bacillus from the blood of syphilitics. The blood in each case was taken from a vein of the arm; in this blood are to be seen the spherical refractile bodies which have been described by other writers, but the nature of which has not been elucidated. The authors believe that the negative results of culture experiments hitherto have been due to the presence in the coagulated blood of a bactericidal alexin. They have used for culture blood-plasma separated from the serum, and also fluid from blisters, which they state is alexin-free. From these on the ordinary media they almost always obtained a culture; in cases primarily negative they were successful by using the method of culture in a collodion sac. The bacillus is polymorphic, either short or thread-like. The appearances on culture-media are described. The bacillus is pathogenic to guinea-pigs, and produces, locally, an indurated ulcer with swelling of the nearest lymph-glands; the organism was in no case found in the cadaver. The blood of syphilitic patients added to a three days' old culture of the bacillus causes agglutination of the latter; normal serum produces no such effect. Inoculation of the bacillus in animals already infected with syphilis was without effect. From a rabbit inoculated from a culture a large quantity of blood was obtained on the third day; on separating this into plasma and serum cultures were obtained from the plasma, not from the serum: an observation which supports the theory of an alexin in the serum. This alexin, the authors state, is "fixed" by the isolated bacillus when the latter is injected into animals already infected with syphilitic products. De Lille and Jullien (*Brit. Med. Jour.*, from *Bull. de l'Acad. de Méd.*, July 2, 1901).



Despite the unsatisfactory results thus far attained in the bacteriology of syphilis, we are, perforce, almost compelled to accept it as of germ origin. The starting-point of the disease is certainly the absorption of a peculiar morbid principle or contagion, the results of which are consistent only with the germ theory. Fessenden Otis, some years since, following Besiadecki and others, expounded the most logical and ingenious theory of syphilitic infection thus far advanced. He claimed that the *contagium* consists of a degraded infectious cell of very minute proportions, which acts by incorporating itself with the normal leucocyte and its derivatives. This view is in nowise inconsistent with the germ theory, and by supposing the incorporation of a specific bacillus with the "syphilitic germinal cell" of Otis, his views are apparently brought up to date. This much may be said regarding the infection of syphilis, namely: however deficient we may be in positive knowledge of the syphilitic micro-organism, we at least have fairly definite views of the manner of its action.

**Primary Local Changes from Infection.**—Although, for the sake of clearness of clinical description, syphilis may be considered a local disease during the first few weeks of its existence, it is nevertheless true that it is practically constitutional from its inception, because we have thus far no means of preventing its systemic results. But, so far as its clinical and pathological histories are concerned, the disease is exclusively local until after the lapse of some weeks following its inception.

The first effect of the syphilitic infection is a gradually increasing accumulation of leucocytes—*i.e.*, white blood-cells, or lymph-cells—at the site of inoculation, produced by a modification of the

normal leucocytes and connective-tissue elements through the influence of the syphilitic infection. This phenomenon probably begins immediately after the infection takes place. It is, however, gradual in its development; hence a certain period elapses before the changes are apparent.

The previously normal accumulated cells (the syphilized cells of Besiadecki, Otis, *et al.*) contain the germs of the syphilitic infection. They become larger, more granular, and contain numerous nuclei; are infectious, and possess exaggerated powers of proliferation and amœboid movement. Associated with these characters is a marked tendency to retrograde metamorphosis. When removed to the tissues of a healthy individual, these cells, by virtue of their infectiousness, *i.e.*, by virtue of the syphilitic germ they contain, produce changes in the normal leucocytes in their new environment, exciting rapid proliferation in them, as well as undergoing rapid changes themselves. Whether the infecting principle be a degraded cell of poisonous properties, the infectious nucleus of a degraded cell, a bacillus, or a cell containing a bacillus,—the two latter, one or both, being most likely,—is of no importance in the subsequent history of syphilitic events, nor does the existence or non-existence of a micro-organism militate against the plausibility and practicality of the views of syphilitic pathology originally presented by Besiadecki and Otis. This much is certain, however, that just as the leucocyte is the primordial cell in the normal physiological processes of growth, so is it the basis of all so-called pathological processes, and particularly those of syphilis, when modified in the manner peculiar to the particular disease.

Taking as our point of departure the initial lesion of syphilis, we note a localized proliferation of the now infected and perverted cells, and, following the infection in its course, thickening of the lymphatic vessels and enlargement of the lymphatic glands. After a time infection-bearing—i.e., microbe-carrying—cells, or perhaps independent micro-organisms, free themselves from the initial accumulation, travel on through the lymphatics, enter the *receptaculum chyli*, and are finally emptied into the circulation by the thoracic duct, to be then driven to the superficies of the body, the central nervous system, and the viscera with the general blood-current.

Conclusions in regard to the histopathology of syphilis: 1. Syphilis primarily infects the lymphatic system and spreads by the lymphatics. 2. The infection of the blood-vessels occurs from the perivascular lymph-spaces. The veins are less resistant, and consequently show the most marked changes, while the arteries, certainly in the earlier lesions, are not so prominently affected as the veins. 3. The specific living syphilitic poison is originally and probably permanently located in the lymphatic system, whence it invades the blood-vessels and leads to the appearance of general manifestations. After such a general outbreak there is established, either in consequence or independent of an antiluetic treatment, an hæmatogenous immunity. This latter, however, lasts only a limited period of time, when a new invasion of the blood-vessels from lymphatic foci may take place. Whether a final complete hæmatogenous and histogenous immunity may be established with the proper treatment or without it, is a question for discussion. Maximilian Herzog (Chicago Med. Recorder, Apr., '99).

Various secondary phenomena now occur in the different tissues: General enlargement of the lymphatic glands,—general adenopathy,—as a result of (1)

the proliferation of the cells carried to them by the blood, (2) the proliferation of their own lymphoid and connective-tissue elements under the stimulus of the infection brought by the syphilized cells, and (3) an accumulation of infected germinal material collected by the absorbents from the superficies of the body. Engorgement of the fauces and pharynx follows, due to a localized cell-proliferation and accumulation in their rich net-work of lymphatics. Mucous patches are likely to occur, and are simply quasipapules upon moist mucous surfaces, due to a circumscribed collection of the characteristic cells,—constituting syphilitic granuloma in whatever lesion it may be found. The same description will apply to the true papule upon the integumentary surfaces. This papule may have an excessive accumulation of cells and become a tubercle, or, from pressure upon and interference with, the nutrition of the normal tissue-elements by the cells in combination with their own tendency to retrograde metamorphosis,—with or without complicating pus-infection,—a pustule, perhaps, forms that may break and result in ulceration. Nodes or peculiar periosteal swellings occurring in syphilis are collections of proliferating syphilitic cells—granulomata.

The foregoing are the essential points in the pathology of active syphilis, as expounded by Otis, modernized by the addition of the microbial view of the disease. Whether the changes following the initial lesion are due to the transference to the system at large of an infected cell, or to the action of a microbe similarly carried, the pathology of the disease as above set forth seems to be logical. There are many phenomena in the course of syphilis to which the syphilized cell bears no particular relation.



Such phenomena were dwelt upon with especial emphasis by the opponents of the syphilitic pathology involved in the foregoing, when originally formulated by Otis. An acceptance of the microbial origin of the disease, however, at once harmonizes the apparent inconsistencies in the theory appearing from time to time in the natural history of syphilis, and seems to answer the arguments of the opponents of the theory so far as this particular phase of their opposition is concerned. Such phenomena as are inexplicable upon the ground of localized cell-accumulation and tissue-obstruction are at once rationally explained by the action of syphilitic toxins elaborated by the specific micro-organism of the disease. The syphilized cell may reasonably be regarded as a carrier of, or as a collaborator with, the specific bacillus of syphilis in the production of toxins.

The danger of permanent injury to the tissues is proportionate to the amount of accumulated cells and the duration of their contact with the normal tissues, with consequent production of secondary changes. A careful study of syphilitic lesions demonstrates the truth of this proposition, whatever theory of the pathology of the disease is accepted. The proposition advanced by Otis in explanation of the foregoing is hardly open to dispute. "The natural course of the syphilitic cell is to accumulate in and obstruct various tissues, thereby forming neoplastic masses similar in structure to inflammatory neoplasia, and finally to undergo retrograde metamorphosis and elimination, resulting eventually in spontaneous cure of the disease."

As to the tissue-changes at the site of inoculation, the first manifestation of the disease is a peculiar lesion characterized by induration. This lesion is due to a localized accumulation of cells infiltrated

in the meshes of the connective tissue and tunica adventitia of the blood-vessels, forming a circumscribed mass. The cells vary somewhat in character, those in the vascular walls being either round, spindle-shaped, or branched; but the bulk of the mass consists of the characteristic round, multinuclear, granular cell. It is obvious that the mass is composed of histological elements derived from transformation of the leucocyte or its derivatives. The changes are similar to those of simple dermatitis, save in the absence of exudate, the induration being dry and hard. The absence of fluid is probably dependent on thickening of the walls and contraction of the lumen of the blood-vessels, which render it difficult for serum to exude from them. This would also explain the relative anæmia and diminished nutrition of the neoplasm. There is also to be taken into consideration a quality of the syphilitic infection too infrequently considered: *i.e.*, the fact that it has absolutely no irritating properties *per se*.

The peculiar affinity of the syphilitic process for the lymphatic tissues in general is evidenced throughout the entire course of syphilis. There is a very intimate relation between the small blood-vessels throughout the body and the beginnings of the lymphatic system. The small blood-vessels are surrounded by perivascular lymph-spaces. It has been claimed that the tunica adventitia of the smaller vessels is really a part of the lymphatic system. This arrangement is to be taken into contemplation in considering the well-known facility with which infections of various kinds are taken up by the constant current existing between the blood-vessels and lymphatics via the tissues and conveyed to the general circulation. It also explains general lymphatic involvement in

infections that primarily enter the general circulation.

Regarding mesarteritis syphilitica, the following conclusions are reached: 1. In the aorta there may be an inflammatory affection of the tunica media, characterized by a circumscribed small-cell infiltration. This infiltration afterward undergoes transformation into a kind of connective tissue poor in nuclei. Accompanying the transformation there is always a certain amount of shrinking. Here and there may be found some necrosis of the media. 2. The tunica intima may be secondarily involved, and may show thickening or may be affected through the scar-like contraction going on in parts of the media. 3. The tunica adventitia may show small-celled infiltration, but more often there is a diffuse fibrous increase without tendency to contraction. 4. The affection has only been observed in syphilitic subjects, and is regarded as an hitherto unrecorded result of syphilis. 5. The affection is very likely the cause of aortic aneurisms in syphilitic subjects. 6. The affection is totally different from chronic endarteritis, though the two may be associated with each other. F. Backhaus (Beit. zur path. Anat., B. 22, H. 3, '98).

The evolution of the other elements of the local manifestations of syphilis—*i.e.*, primary lymphoplasia and adenopathy—is practically a duplication of the changes occurring in the initial lesion. Within a few days after the latter appears the lymphatic vessels leading from the infected surface enlarge and harden, often resembling pieces of pencil or wire beneath the skin or mucous membrane. The degree to which inflammation enters into the process depends upon the amount of irritation of the primary lesion and the presence or absence of mixed infection. Typically, the lymphatic lesion is an hyperplasia rather than a lymphitis. It would appear that the local influence of the infection travels with slowness and deliberation. After a time the lymphatic glands into which the

lymph-current from the infected area flows react to the infection and primary adenopathy occurs. No general involvement of the lymphatic glands occurs for some weeks, apparently not until the infection has had time to reach the general lymphatic system via the tissue-lymphatics, the central lymphatic circulation, and the general blood-circulation. If the infection is not local in its influence primarily, this is a singular phenomenon, for there is no reason why there should not be almost simultaneous involvement of all the lymphatics of the body, granting that the infection is general from the start. Each involved gland would appear to be a depot for the storing up, production, and finally the distribution of the infection. Each lymphatic gland is affected by a tissue-hyperplasia precisely similar to that existing in the initial lesion. It becomes hard and woody to the touch, its circumscription and induration being explicable upon the same ground as the same qualities of the initial lesion.

The changes at the site of infection and in the lymphatic glands and vessels first involved have been most appropriately termed the initiatory period of syphilis.

**The Initial Lesion, or Chancre.**—The typical initial lesion is an induration pure and simple. The facilities for mixed infection and for irritation of the lesion are so many and various, however, that a simple induration without solution of continuity of skin or mucous membrane is exceptional. Chancre, as the initial lesion is most frequently termed, presents itself in the following forms: 1. A superficial loss of epithelium forming a non-suppurating open lesion. This is termed simple erosion. 2. A greater or less area of ulceration, saucer-shaped, due to irritation and syphilitic pus-infec-





Syphilitic Chancre, showing the muscle or blood-red hue very frequently witnessed (Fournier.)





tion. 3. A deep ulcerative excavation with sloping edges. 4. Herpetiform and crustaceous chancre. 5. Diphtheroid or so-called diphtheritic chancre. 6. An indurated, non-secreting *plaque*, papule, or tubercle. It will be understood that the open varieties of chancre present in typical instances an underlying more or less characteristic induration. (*See colored plate.*)

Erosion may be said to include about two-thirds of chancres, and is usually situated upon the mucous membrane, very often inside the prepuce in the male. In shape it is oval, or perhaps a trifle irregular, with a raw, polished surface of a wine-red color and sometimes a pultaceous base, but usually secreting a simple thin, sanious fluid, devoid of pus, or at least containing a very small amount of pus-corpuscles. These erosions are flat, and may surmount a thin parchment induration, or may cap a hard tubercle as large as a marble. Superficial ulceration with sloping edges—the ulcer presenting a saucer-shape—is found with the parchment, but most often with the split-pea, induration. When this ulceration caps a large mass of induration, it is likely to be quite deep and funnel-shaped from extensive necrobiosis, constituting the so-called “Hunterian chancre.” The secretion from a chancrous ulceration is quite likely to be of a seropurulent character. Herpetiform and crustaceous chancres may occur in any situation. The simple indurated papule or tubercle is usually found upon the skin, the integument of the penis, or even upon the prepuce itself when it is short and dry. Ulceration of this form of induration might occur if it were kept moist, the conditions of warmth, moisture, and irritation combined being especially favorable to the production of ulceration. The parts upon which it de-

velops are perhaps not so rich in lymphatic spaces as those in which a chancre is more likely to ulcerate, the collection of cells being consequently smaller and the tendency to necrobiosis less marked.

Several unusual types of chancre have been described. French authors describe a variety called the “herpetiform.” This seems to be simply a lesion of herpes that becomes infected with syphilis and eventually indurates. In some cases the rationale of its formation is exceedingly simple. At the time of exposure to syphilis the subsequently infected surface comes in contact with some local irritant. The patient being predisposed to herpes, one or more vesicles develop within a short time after exposure. The chancrous induration develops in the herpetic lesion later on, at the end of the period of incubation. Fournier describes a form of chancre that he terms “crustaceous.” This, he claims, may be confounded with scabies, which latter disease may present pseudo-induration and inguinal adenopathy. This condition yields to sulphur, which chancre does not. Fournier claims, however, that expectancy is the only recourse in the differential diagnosis of crustaceous chancre.

The symptoms of urethral chancre, when too deep to be seen without the urethroscope, consists in a discharge coming on after the usual period of incubation, this discharge being thin, and perhaps sanious, but sometimes creamy and thick. There is a painful spot in the urethra that is especially noticeable during micturition and erection, with possibly a lump in the course of the canal, plainly perceptible on palpation with the thumb and finger in some cases. The character of the discharge depends upon the degree and character of the complicating urethritis. The characteristic symptoms of stricture may be present,

produced by the pressure of the chancre upon the urethral lumen. By means of the urethroscope an ulcer may often be detected, and in a short time the general enlargement of the glands and other symptoms clear up the diagnosis. Great caution is necessary in making a diagnosis until these confirmatory symptoms appear. The writer desires to call attention to a peculiar form of urethral chancre that may lead to grave errors in diagnosis. This appears as a slight erosion of a milky color, just within the meatus. Induration is not perceptible and the lesion looks not unlike an intra-urethral herpetic lesion.

VARIETIES OF INDURATION.—The initial induration—initial sclerosis—may present itself under several different forms:—

1. The simplest form, the parchment induration, usually underlies ulceration, and may escape notice unless carefully sought by pinching up the lesion with the thumb and finger so as to press lightly upon its edges without bending it. This is the commonest form, according to some authorities, and is certainly so in hospital practice. In private practice, however, examples of the Hunterian chancre, or other marked forms, are more frequent in the writer's experience.

2. There is a variety of the parchment induration sometimes seen that is especially apt to escape attention, so insignificant does it seem. It consists in a very superficial cell-infiltration, presenting a very slight induration when lightly pressed upon. In appearance it is a slightly-brownish patch covered by very fine scales, not unlike a minute patch of psoriasis. This superficial induration is called by Otis the "dry, scaling patch." The author would suggest as a better term "squamous induration."

3. The induration may be somewhat

like a split pea beneath the skin, its convex surface being capped by ulceration. This induration is plainly marked and freely movable, with a feeling like wood or bone, or perhaps more nearly like cartilage.

4. The induration may be large and extend beyond the bounds of the ulceration, often attaining the dimensions of a chestnut or almond. There may or may not be ulceration. When an induration of this description is ulcerated, its convexity is sometimes capped with a funnel-shaped ulcer,—the whole so-called Hunterian chancre. In many cases there is merely a hard, purplish lump, with no ulceration, or, at most, a very superficial erosion capping the induration. In many cases the induration is irregular, sometimes presenting several distinct tumors, or united by areas of less marked induration, giving, in the case of the penis, a "choked" appearance to the organ.

5. A very superficial infiltration may underlie a pseudomembrane of greater or less dimensions: "diphtheritic chancre."

LOSS OF TISSUE IN CHANCRE.—The occurrence of ulceration in chancre is quite important, and, aside from the various sources of irritation that may act as exciting causes, is explicable by the histological characters of the lesion. As already noted, the chancre consists of localized cell-accumulation that not only presses upon the capillaries, but actually invades their walls, thus causing a diminution of blood-supply and relative anæmia and malnutrition of the neoplasm and tissues involved by it. This malnutrition gives rise to molecular disintegration of the superficial layers of the lesion, which break down and, becoming infected, form an ulcerated surface.

The induration of chancre is variable in its extent, according to the tissues in which it is situated, and within certain



limits is proportionate to the extent of surface primarily infected: *e.g.*, when an extensive cut or abrasion is inoculated with the syphilitic infection, the resulting chancre is likely to assume the size and conformation of the traumatic lesion.

In quite rare cases of chancre, or apparently simple lesions followed by constitutional syphilis, induration appears to be entirely absent. This is, perhaps, due to the fact that it has been overlooked through carelessness or co-existence with chancroid, or it is so slight that it escapes attention. After a chancre becomes phagedænic, induration shortly disappears.

It is a peculiar, and at the same time unfortunate, fact that typically indurated chancre is a rare thing in women. Venereal sores appear and disappear, and contagion is spread about promiscuously in many instances, while the patient is entirely unconscious of her trouble.

In simple chancre the induration most generally precedes the ulceration, but often follows it, coming on during the first week. The primary occurrence of ulceration is probably due to some irritant acting chemically, or chancroidal or purulent infection occurring simultaneously with the syphilitic infection. This is the invariable course of mixed sores, and it is highly probable that the majority of lesions in which induration follows, instead of preceding, ulceration are primarily either chancroid, herpes, or simple ulceration from pus-microbes.

The induration of chancre may be transitory, and, as already indicated, may disappear so rapidly as to be overlooked. Cases have been observed in which it lasted only ten or twelve days, but such cases are exceptional, the ordinary duration being from one to three months, in rare cases lasting for some years.

SECRETION OF CHANCER.—The secre-

tion of syphilitic chancre is very scanty and sero-purulent for reasons already given, and retains these characters throughout unless the sore becomes inflamed, in which case it becomes profuse and purulent, and perhaps bloody. Some chancres exhibit a marked tendency to bleed. A number of cases have occurred in the writer's practice in which this symptom was quite persistent and recurred upon the slightest manipulation of the sore: the so-called "hæmorrhagic chancre."

Many attempts have been made with syphilitic secretions, and especially the secretion of the chancrous ulcer, but autoinoculation has thus far been found impossible, as a rule. When chancre is inflamed and secreting profusely, its secretion—containing toxins and pyogenic microbes—will produce a pustule if autoinoculated, acting like any other irritant. This pustule may be followed by ulceration, but never by hard chancre. When the sore is mixed, autoinoculation is, of course, feasible.

COMPARATIVE FREQUENCY OF CHANCER AND CHANCROID.—The relative frequency of chancre and chancroid is variously estimated by different observers. Thus, Fournier finds in his private practice that the frequency of chancre as compared with chancroid is about three to one. The statistics of ten years at one of the large Parisian hospitals show that chancroid comprised about 80 per cent. of sores. From clinical experience the writer is inclined to believe that these estimates are fair criteria of the relative frequency of the two varieties of genital sore as seen in both private and hospital practice. It must be remembered, however, that in hospital practice patients with atypical and possibly mixed sores are often lost sight of after they leave the hospital. Doubtless many of

these afterward develop syphilis, thus cutting down the percentage of simple chancroids.

**Complications of Chancre.**—There are some complications of syphilitic chancre that demand attention: 1. First and simplest we have vegetations or papillomatous growths: the so-called venereal warts. These result from local irritation combined with heat and moisture, and are identical with vegetations occurring under other circumstances. The writer believes that, while simple genital papillomata are in no sense syphilitic, they, like herpes progenitalis, thrive best on syphilitic soil. Proper measures of cleanliness will usually prevent the formation of vegetations. 2. Inflammation of chancre — pus-infection — sometimes occurs, giving rise to considerable pain and profuse purulent secretion. 3. Chancre may be complicated by chancroid, constituting “mixed sore,” unless the two forms of disease appear in different locations. 4. Chancre may be attacked by phagedæna or gangrene.

**MIXED CHANCRE.**—When a chancre becomes inoculated with chancroid, its ulceration deepens and it gradually assumes the general characters of chancroid; but, unless phagedæna occurs, induration usually still persists. Oftener than is usually supposed, however, the chancroidal process inhibits the development of chancrous induration, or initial sclerosis; as a consequence, syphilis often-times follows an apparently typical soft sore. Slight sclerosis is very apt to be melted away, so to speak, by the chancroidal infection, and thus escape attention. When chancroid develops primarily—from typical mixed infection—it generally runs its usual course until the incubation period of syphilis has elapsed, when induration occurs. The secretion of the mixed sore is autoinoculable, and

capable of transmitting either disease alone, or both together, to a healthy person. In some cases chancroid appears and rapidly heals, or the incubation period of syphilis is long, and induration develops in the cicatrix of the chancroid after it has soundly healed.

The test for mixed chancre is autoinoculation. Any indurated sore, the secretion of which is autoinoculable in the true sense of the word, and which is followed by constitutional syphilis, is a mixed chancre. By the term autoinoculable is meant a sore the secretion of which, inoculated in a new situation in the diseased individual, will produce typical chancroid.

The methods of contraction of mixed chancre are two, viz.: (1) both poisons may be contracted simultaneously, or (2) either variety of genital lesion may develop primarily and subsequently become inoculated with the other form of disease.

Typical syphilitic chancre—initial sclerosis—may undergo marked transformations: *e.g.*, a chancrous induration, particularly when situated in a moist locality, such as a mucous or quasimucous surface, may lose its hardness and at the same time become transformed into a quasimucous patch by becoming covered with a characteristic whitish pellicle. In some instances the sore acquires the form of the mucous patch, yet retains its characteristic induration. Morrow has described a “diphtheritic” variety of chancre. It is possible that this may sometimes be the mucous transformation just described, and not a special variety of lesion, but the author has met with cases corresponding exactly with Morrow’s description.

**PHAGEDÆNIC CHANCRE.**—Phagedæna may attack true chancre, and when it does so is quite likely to be of the gangrenous



form. The pultaceous and serpiginous varieties are quite rarely seen under such circumstances. After phagedæna has once invaded a chancre, induration is no longer perceptible. If the sore be of the mixed variety, the pultaceous or serpiginous form of phagedæna is then quite likely to develop. Such authorities, as Bassereau and Diday, think that the type of syphilis following phagedænic chancre is apt to be exceptionally severe. This is true in my experience, but is explicable by the fact that phagedæna, *per se*, is probably due either to general debility or a peculiar diathesis that lessens both local and systemic resistance to disease and especially to syphilis, rather than by an extraordinary intensity of the syphilitic infection. The question of a special germ infection in phagedæna is still *sub judice*.

**Infectious Secretions in Syphilis and Infection.**—Inoculations with the secretions of chancre, mucous patches,—in short, all secondary cutaneous or mucous lesions capable of yielding a discharge,—and of syphilitic blood have been made with entire success. Whether the blood is infectious between the periods of active manifestation of the disease has not been determined by experiment, but from accidental observations made upon vaccinal syphilis it probably is. There is no logical reason why the blood should not be infectious at such times, for each successive crop of lesions is not due to a new development of syphilitic infection, but to its renewed activity. The secretions of non-syphilitic lesions occurring upon a syphilitic are not inoculable unless mixed with the blood of the syphilitic subject: *e.g.*, the secretions of gonorrhœa and chancroid occurring in a syphilitic produce in another individual only gonorrhœa and chancroid unless they contain syphilitic blood. Diday in-

oculated pus from acne pustules produced by potassium iodide on a syphilitic subject, but with negative results. It is also probably true that a vaccine-lymph derived from a syphilitic is not capable of producing syphilis unless it contains some of the patient's blood. This, however, should make the physician none the less cautious, for it is very easy for a small quantity of blood to become mixed with the lymph and remain undetected. The vaccine-scab from a syphilitic patient is always dangerous, as it invariably contains a certain proportion of dried blood in its composition.

Inoculations with the secretions of tertiary lesions and with blood during the tertiary stages of syphilis are negative, although there have been apparent exceptions to the rule.

The non-transmissibility of syphilis during its tertiary period is perhaps the strongest evidence that the lesions of this stage are not syphilitic at all, but simply sequelæ. None of the physiological secretions, such as mucus, sweat, urine, milk, and semen, are inoculable, unless they contain either syphilitic blood or the secretion of a syphilitic lesion. The saliva, so often the medium of contagion, is innocuous unless mucous patches or other lesions exist in the mouth, in which case it is contagious in the highest degree. The syphilitic infection—be it cell or bacillus—must be present, else no secretion, physiological or pathological, can transmit syphilis.

In every method of transmission of syphilis, save two, the general disease is always preceded by chancre, and the existence of the latter may be inferred whether it has been detected or not. Chancre is never present in the case of (1) infection of the child *in utero* and (2) the infection of the mother through the medium of the child, the latter mode

of transmission being still a subject of controversy.

In 4142 cases of syphilis occurring in personal practice it was found that in 193 cases of tertiary syphilis the patients denied that they had been or were infected. The causes of ignored syphilis are to be found (a) in the fact that women, knowing much less about syphilis than men, are more frequently infected without knowing it. (b) The frequency of extragenital chancres. Of 100 chancres, from 8 to 10 are extragenital. (c) Infantile, wet-nurse, and professional contaminations are often erroneously interpreted. Midwives and physicians are often infected, and do not know it. (d) Many cases of syphilis remain ignored, owing to the manifestations having escaped notice or having been falsely interpreted. Mucous patches about the anus have been mistaken for hæmorrhoids, syphilides of the mouth and throat for simple anginas, syphilitic cephalalgia for migraine, and osteocopic pains for rheumatism. Often the woman is infected by her husband. On the first appearance of symptoms the husband rushes to the family physician and begs of him to reveal nothing. The wife, disbelieving that she has syphilis, refuses to take treatment for it. To obscure lesions, even if the patient denies syphilitic infection, syphilis may be the cause at work. Proceeding on this hypothesis, in a large number of cases, excellent results have been obtained. Fournier (*Jour. de Méd. et Chir.*; *Jour. Cut. and Genito-Urin. Dis.*, Aug., '99).

**Modes of Contagion.** — The methods of contagion in syphilis are classified as mediate and immediate. By the mediate method we understand the transmission of the disease through the medium of infected drinking-utensils, tobacco-pipes, towels, etc. Chancroid is very rarely transmitted in this way, but syphilis is often so transmitted on account of the multiplicity of its lesions, that are sometimes apparently so insignificant, but none the less infectious. By the immediate method of contagion is implied the

direct contact of an abraded surface in a healthy person with a secreting lesion or infected surface, or with syphilitic blood from a non-syphilitic lesion, in a syphilitic subject. The type of this mode of contagion is, of course, infection during sexual intercourse, but the disease may be immediately inoculated in many other ways; quite often it is contracted by the physician or surgeon in operating upon or examining syphilitic subjects.

Chancre is sometimes contracted in kissing, a small, insignificant-looking—perhaps unrecognized—mucous patch upon the cheek, lips, or tongue of the diseased person inoculating any slight fissure or abrasion that happens to be present about the mouth of the healthy subject.

The duration of syphilitic chancre is variable. It may last for a couple of weeks, but in the majority of cases an eruption appears prior to the disappearance of the chancre. It may last for some months, especially if complicated. Cases arise in which the induration lasts for years.

Chancre is generally single, but may be multiple, according to the number of points primarily inoculated. It is usually situated upon the genitals, behind the corona glandis in the male especially; but its situation varies greatly, as may be readily understood upon considering its numerous methods of contagion. Chancres of the face, tongue, nipple, and fingers are not so very rare, and instances of chancre of the tonsil have been reported. Urethral chancre is not uncommonly seen.

**Chancroid bacillus.** This organism is present in the purulent secretions of the great majority of cases of chancroid, and occasionally also in the pus of buboes, and may be identified by its morphology and staining reaction, together with its ability to grow on ordi-



nary culture media. Characteristic growth of the organism in a pure state may be obtained in suitable media from genital chancroids direct, and also from chancroidal buboes in some cases. Growth is most luxuriant in a medium of fresh blood and bouillon, but unmixed human blood is the best medium for obtaining cultures from a source open to contamination. Inoculation of a pure culture of the bacillus or of chancroidal pus on the skin of a certain species of monkey reproduces the lesion, from which in turn the original organism may be recovered in culture. The cultivation of the same organism in a pure state from lesions on the hands, clinically resembling chancroid, in the absence of genital lesions, indicates that chancroid may be primary on an extragenital site. Bacteriological examination of all ulcers of this type is likely to establish in the future a greater prevalence of extragenital chancroid than has hitherto been reported. Lincoln Davis (*Journal of Medical Research*, June, 1903).

### General Infection, or So-called Secondary Syphilis.

The initiatory period of syphilis terminates when the infection has traversed the lymphatics leading from the chancrous surface, entered the receptaculum chyli, and from thence passed into the blood, through the medium of which it is disseminated throughout the system, giving rise to the peculiar changes characteristic of syphilis in every tissue and organ, the changes being more marked in some parts perhaps than in others in different cases, though there is no tissue that enjoys complete immunity from the ravages of the disease.

Venereal warts, so called, are hypertrophies rather than tumors. They are inflammatory, being due to irritation. These papillary overgrowths constitute from 1 to 2 per cent. of all cases of genito-urinary disease; 60 per cent. are venereal and are due to acrid, irritating discharges; the remaining 40 per cent.

are nonvenereal and are due to uncleanliness and maceration of their seat alone. They are not confined to mankind, dogs and horses also being subject to them. Ruminants are exempt. When small, the best treatment is palliative; when large, they are best removed surgically. Even then recurrences are frequent.

The term "papillofibroma" most correctly defines these interesting pathological new-formations. The question as to whether or not venereal warts are infectious or contagious is, as yet, purely a speculative one. Numerous Gram-staining bacteria are seen, embedded in the epithelium and in the lymph channels. The demonstration of micrococci and bacilli in these lesions suggests that the hypertrophy and hyperplasia of tissue may be produced by certain irritating products of these bacteria. C. W. G. Rohrer (*American Journal Medical Sciences*, Nov., 1904).

Following the initiatory period, with its initial sclerosis and primary adenopathy, there is an apparent period of incubation lasting, on an average, forty to forty-five days, and followed by general symptoms. During this so-called second stage of incubation the syphilitic infection is slowly traversing the lymphatics and gradually making its way into the general blood-current.

The Justus blood-test for syphilis depends on the asserted fact that a single inunction of mercury in all untreated cases of secondary, tertiary, and congenital forms of syphilis causes a reduction in the hæmoglobin, due to the sensitiveness of the red blood-corpuscles to the action of the drug, while in non-syphilitics no reaction occurs. Test personally applied in 53 cases drawn from the service at Gouverneur and Bellevue Hospitals. Of 17 active syphilitics, 13 responded and 4 were negative. Out of 15 cases of chancre, only 3 responded, and all the control cases, 18 in number, were negative. However, it is likely that it may be a very valuable method of corroborating a diagnosis. D. H. Jones (*N. Y. Med. Jour.*, Apr. 7, 1900).

The Justus test has no practical value in the differential diagnosis of venereal ulcers, since the reaction occurs with an almost equal degree of frequency in the non-syphilitic conditions with which syphilis may occasionally be confused. The summary of the writer's cases, with the percentages of positive results, is as follows: 13 cases of the initial lesion with 38 per cent.; 7 of chancreoid with 57 per cent.; 3 of herpes with 100 per cent.; 3 of genito-urinary tuberculosis with 33 per cent.; 1 of pustulo-crustaceous syphilide with 0 per cent. Tucker (Phila. Med. Jour., May 10, 1902).

**GENERAL ADENOPATHY.**—The syphilitic infection eventually arrives at the receptaculum chyli, from which it is carried to the general circulation, and after entering the right heart is finally disseminated throughout the tissues generally, producing its characteristic effect of cell-proliferation, the first evidence of which usually consists in a general glandular enlargement. This, however, may appear simultaneously with or follow the discovery of the roseola. On section, the enlarged glands are found to be, histologically and macroscopically, reproductions of the adenopathies of the initiatory period.

The so-called blood-platelets were found in large numbers by the author in the blood of syphilitics irrespective of the stage of the disease or the symptoms that may be present. He emphasizes the fact that they are by no means specific to syphilis, and found that they disappeared when the antisyphilitic treatment had been carried on long enough to overcome the anæmia that accompanies that disease. H. Voerner (Deutsche med. Wochen., Dec. 11, 1902).

**THE ROSEOLA.**—At the end of about forty to forty-five days, on the average, after the development of the initial sclerosis, the period of "general, systemic infection and localized cell-accumulation" begins, the infection having now reached its final destination. The first evidence of general infection in order of discovery

usually consists in the development of a peculiar eruption of rose-colored spots: the syphilitic roseola. Although this eruption may escape observation, it is probably constant, being always present in a greater or less degree, in some cases lasting for a number of weeks, probably from two to eight, while in others it may last only a few hours. In its general appearance the eruption is not very unlike measles. The spots are of a dull, rose-red hue, and disappear on pressure when recent, but later on leaving a coppery stain.

The syphilitic roseola is due to dilation of the cutaneous capillaries, with subsequent stasis, and the exudation of leucocytes and red blood-corpuscles into the implicated integumentary area. It is possible that the dilation and stasis are reflex phenomena due to reflected local irritation produced by the syphilitic infection, or to the direct influence of the infection upon the vascular walls; but this explanation is hardly so rational as that involving a direct influence upon the sympathetic centres analogous to that produced by quinine, belladonna, and various other drugs and by emotional disturbances. The disturbing element in the action of syphilis on the sympathetic is probably a toxin or toxins elaborated by the syphilitic micro-organism.

**SYPHILITIC PRODROMES.**—The roseola may be preceded or accompanied by various phenomena of a general character. Among these phenomena are malaise, headache, backache, rheumatoid pains, anorexia, nausea, prostration, sleeplessness, and nervous irritability, and in some cases quite sharp febrile movement, perhaps followed by perspiration. These are the symptoms several or all of which have been included under the head of syphilitic fever, or, as Diday more correctly terms them, "syphilitic pro-



dromes." It has been claimed that, on reviewing the list of single symptoms that may occur, it is evident that they may be dependent upon so many and various coincident disturbances that there can be no great constancy or certainty about their occurrence in syphilis, and that the term syphilitic fever is therefore obviously inaccurate. This observation, however, may be fallacious because of faulty methods of study. The various symptoms are toxæmic, and, although they vary in severity, might be found to exist in greater or less degree in all cases by very careful investigation. The temperature, be it remarked, is rarely studied.

Some of the results of secondary syphilis, which are important owing to the fact that they are difficult to diagnose in the absence of distinct history, and from the fact that they are much more frequent in women than in men, pointed out. The first is headache, which may be divided into three degrees. In the first it is troublesome, but does not interfere with the ordinary vocations. In the second the pain simulates migraine. In the third the pain is so severe as to render any exertion or employment impossible. It is accompanied by vertigo, ringing in the ears, and in many cases there may be a profound melancholia. The pain may be constant or intermittent. In the first it is more severe toward the evening; in the second form it comes on every evening between 5 and 7. Antisyphilitic treatment is followed by an astonishing relief of the symptoms. Another manifestation is insomnia. In many instances this may be due to headache, but in other cases there may be no headache or other symptom, the patient passing several nights without sleeping. Another phenomenon in secondary syphilis is asthenia. Like the other symptoms, it is almost confined to women. There may be inability to stand or even to leave the bed. The heart-beats are extremely feeble and the pulse almost imperceptible. There is a dullness of perception affecting all the senses, and the trophic functions are

greatly in abeyance. Malignant disease, tubercle, different forms of anæmia, etc., have been diagnosed. Vague neuralgic pains may affect the sciatic or different branches of the fifth nerve. Antisyphilitic treatment, more particularly preparations of mercury, should be tried in many cases of anomalous neuralgic pain. Fournier (*Jour. de Méd.*, Apr. 10, '99).

PHARYNGO-FAUCIAL INFILTRATION.—About the time the roseola appears, sometimes shortly before or after it, there is a development of inflammatory engorgement of the tonsils, pharynx, and soft palate, involving usually the whole faucial surface. The explanation of the involvement of the fauces and pharynx characteristic of secondary syphilis, upon the ground of lymphatic engorgement, the primary cause of which is the abundance and superficial character of the lymphatic capillaries of the affected parts, is quite plausible. That vasodilation due to the action of syphilotoxins upon the sympathetic is an associate factor is possible.

Among 2500 consecutive cases treated in the ear department of the Pennsylvania Hospital, 7 were distinctly of syphilitic origin. Bulkley, in an analysis of 9058 extragenital chancres, found 27 cases in which the sore was located on the external ear. Secondary and tertiary manifestations are met with much more frequently. Hereditary syphilis of the ear manifests itself most frequently in the middle and inner ear. Syphilitic disease of the middle ear originates usually from infection through the Eustachian tube. Lesions of the internal ear occur very late in the course of syphilis. The symptoms of this condition are tinnitus and deafness coming on suddenly in either one or both ears, and not infrequently accompanied by unilateral facial palsy. Packard (*Jour. Amer. Med. Assoc.*, Feb. 2, 1901).

THE PAPULAR SYPHILIDE.—The next thing observable after the roseola in the typical course of syphilis is the devel-

opment of an eruption of true papules. This may appear when a roseola has not been noticed, thus seeming to be the first skin-lesion of the disease, or may even be coincident with it, but generally follows it after a variable interval: often some weeks or months. The papules are usually most prominent about the borders of the hair upon the forehead, forming a peculiar appearance termed the *corona veneris*, or venereal crown, but may be scantily scattered over the breast, back, and limbs. In still other instances they may be thickly studded all over the body. This eruption lasts longer than the roseola, occasionally remaining prominent for a number of months. It is at first of a tolerably bright-reddish hue, but this gradually fades, leaving the characteristic ham color.

**SYPHILITIC ALOPECIA.**—During the period of general syphilis, usually during the early months of the secondary period, often co-existent with the papular eruption, falling of the hair, or alopecia, occurs. This results from derangement of nutrition in the hair-follicles. The loss of hair may be general, but it usually occurs in patches—*alopecia areata*—that are quite characteristic. In rare instances the entire body is denuded of hair.

This lesion of early syphilis especially appeals to the writer as a syphilitic neurosis: a trophoneurosis, in brief. This may be dangerous ground, for the close association of alopecia with tangible cell-deposit in other situations has led to the tacit acceptance of this lesion as an evidence of the action of the *materies morbi* of syphilis *in loco*. Some authorities believe it to be due to local poisoning of the hair-follicles, with resultant nutritive perversion.

**SYPHILIS OF THE NAILS.**—The nails

of the fingers and toes may become affected by the syphilitic cellular infiltration, and become brittle and lustreless, or from very great infiltration and consequent nutritive disturbances—and perhaps secondary pus-infection—the destructive lesion known as syphilitic onychia may occur, presenting an obstinate ulceration around and beneath the nail.

**PUSTULES, VESICLES, AND PRECOCIOUS SKIN-LESIONS.**—Pustules or vesicles may form during the papular stage of syphilis. Ulcerations resembling tertiary or late secondary lesions may also occur. These latter constitute precocious syphilides.

**SPECIAL MUCOUS LESIONS.**—There are several peculiar lesions occurring during the period of general syphilis that are both important and interesting, but which are really mere modifications of the syphilitic papule dependent mainly upon their situation and surroundings. Mucous patches upon the various mucous surfaces or quasimucous surfaces, where they are constantly subjected to irritation from friction, heat, and moisture, are examples. These lesions are elevated *plaques* of a milky or grayish color, covered with a grayish exudate, and are not greatly unlike the primary superficial erosion sometimes seen upon the genitals. When situated about the anus, upon the scrotum, vulva, or between the digits, these *plaques muqueuses* tend to become hypertrophied, forming broad papules or excrescences more or less elevated, sometimes covered with a quasidiphtheritic deposit, and usually secreting a foul-smelling serous secretion. These modified mucous patches are termed mucous tubercles, or condylomata.

**VISCERAL INVOLVEMENT.**—Visceral engorgements and infiltrations are by no means uncommon in syphilis, congestion



characterizing the early secondary, diffuse infiltration the late secondary, and distinct gummy deposit the sequelar period. Tenderness over the liver, spleen, and kidneys is occasionally observed in early syphilis. Transient albuminuria is not uncommon.

Syphilis of the stomach is not so rare as might be believed. The lesions present themselves under various forms: hæmorrhagic erosions, ecchymosis of the mucous membrane, gummous patches, etc. When the symptoms of *ulcus simplex* are observed in a syphilitic person, it is natural to suppose the gastric lesion is of itself syphilitic. It should never be forgotten, when in presence of gastric ulcer, to look for syphilis in the antecedents of the patient and apply the treatment accordingly. Dieulafoy (*Canada Lancet*, Aug., '98).

In 60 cases of recent syphilis, an undoubted enlargement of the spleen yielding to specific treatment was found only 4 times. Splenic enlargement was also found twice in 4 cases of malignant syphilis. From these and other observations it appears that in early stages of syphilis enlargement of the spleen can only seldom be made out with certainty. At present, therefore, the condition of the spleen does not help one to draw any conclusions regarding diagnosis or treatment. C. Bruhns (*Deut. Arch. f. klin. Med.*; vol. lxiv, p. 451, '99).

Syphilis of the heart is rare and is followed by interstitial or gummatous myocarditis. It may affect the coronary arteries alone. The symptoms are the same as in other forms of myocarditis. Some improvement will follow specific treatment, which confirms the diagnosis. The prognosis depends upon the age of the patient. In gonorrhœa, on the other hand, endocarditis is not uncommon, the myocardium only becoming involved secondarily. Gonorrhœal endocarditis may be acute and malignant or chronic and benign. The diagnosis is not so difficult as that of syphilitic myocarditis. G. Fischer (*La Presse Méd.*, Jan. 15, 1902).

**EARLY OCULAR SYPHILIS.**—During the active period we often have ocular

troubles that may prove of very serious import. An infiltration of cells into the iris and ciliary body often sets up an iritis at this time, this inflammation being in no way distinguishable from the iritis produced by rheumatism, trauma, or other exciting causes. The local accumulation of cells in these cases sometimes forms a distinct nodule, or tumor, often erroneously termed "gummy tumor of the iris," but which is in nowise different in structure from the syphilitic papule. This is especially apt to occur in late syphilis, in which event it may, perhaps, be justly styled "gummous." Similar plastic nodules may form in the choroid at this period.

Two years ago the undersigned stated that the absence of the pupil-reflex to light, if permanent and unaccompanied by any change in the eyeball or optic nerve, or paralysis of the third pair, is almost pathognomonic of hereditary or acquired syphilis. Experience since has convinced them that the absence of the pupil-reflex under these circumstances may be the only sign of an organic affection of the nervous system, and that patients thus affected are liable to be attacked by tabes, general paralysis, or confirmed cerebro-spinal syphilis. G. Babinski and Charpentier (*Bull. de la Soc. des Hôp. de Paris*, May 25, 1901).

**EARLY OSSEOUS SYMPTOMS.**—Bone-pains, usually localized, and localized subperiosteal accumulations of cells termed nodes frequently occur during early syphilis, although more characteristic of late syphilis. The pain in these instances is due to intra-osseous or subperiosteal pressure produced by the dense accumulation of cells.

**EARLY NERVE INVOLVEMENT IN SYPHILIS.**—Syphilitic toxins occupy a very prominent position in the etiology of early syphilitic nerve disease. They also bear a more remote relation to some of the early types of nerve-phenomena. They apparently act in several ways, viz.:

(A) By direct intoxication of nerve-tissue. (B) By the induction of vasomotor changes via the sympathetic ganglia or the so-called monarchial vasomotor centre in the medulla. (C) Direct intoxication and irritation of blood-vessels in the nervous system. Organic or functional nervous disturbance is produced by syphilitic new growth in numerous ways, viz.: 1. By invading the lymphatics surrounding nervous structures. 2. By involving the tissues, chiefly the lymphatic vessels, surrounding the blood-vessels supplying or draining the part. 3. By invading the arterial walls. 4. By infiltration of connective and other tissues about nervous structures. 5. By involvement of the nerve or brain parenchyma proper. 6. By involving nerve-sheaths or the cerebro-spinal meninges. These various conditions act by producing: 1. Irritation. 2. Pressure-innutation, and occasionally degenerations. 3. Passive hyperæmia and œdema from venous obstruction. 4. Localized anæmia (ischæmia) from arterial obstruction. 5. Blocking up of the affected area by lymphatic obstruction.

Any of these conditions may occur in both the active and the sequelar periods, and prove very destructive. It is rare that extensive destruction of tissue from breaking down of the neoplasm occurs in the earlier nervous lesions. It is to be remembered, however, that gumma may develop at an early period from the intrinsic malignancy—precocity—of the disease.

**The Period of Sequelæ, or So-called Tertiary Syphilis.** — **THE TUBERCULAR SYPHILIDE (GUMMY INFILTRATION).** — One of the most frequent and important of the tertiary lesions, or sequelæ, is the tubercular eruption. This has been said to be due to a localized accumulation of morbid cell-material in the tissues—

so-called “gummy infiltration”—that is the type-basis of all tertiary lesions. This gummy material is termed by Wagner “syphiloma,” and is described by him as an infiltration of cells and nuclei, the cells not being capable of differentiation from the normal white blood-cells or leucocytes and the nuclei themselves presenting no characteristic appearances. He states that their morbid effects are due to a mere interference with the function and nutrition of affected parts by simple pressure. Baümle also claims that the histological elements of syphilomata lack specific microscopical characters.

The tubercular, or gummy, lesion may develop in any situation, its favorite locations being the cellular tissue, skin, bones, liver, testes, brain, and kidneys, and, in children especially, the lungs.

Syphilis can manifest itself in the veins. There are two forms of syphilitic phlebitis. The first is acute or subacute, and corresponds to the secondary period of the disease. The other form is chronic, and corresponds to the tertiary period of the disease; it may be localized (gumma of a vein) or generalized (phlebosclerosis). The phlebitis of both secondary and tertiary syphilis affects the veins of the lower extremities by preference. The prognosis is generally favorable, the average duration being two months. R. Heuzard (Thèse de Paris, No. 179, '98).

This gummy material is a grayish-red, homogeneous mass of greater or less consistency, that may be found in the parenchyma of any organ or tissue of the body, either as a diffused or circumscribed infiltration, but never capsulated. When this accumulation of morbid material is superficial and exposed to unequal pressure, and when it is excessive or involves the walls of the blood-vessels, thus giving rise to localized innutrition from pressure or vascular obstruction, the whole mass is liable to disintegrate and form an open lesion, or break down into



pus or puruloid material that may absorb through fatty or granular degeneration without ulceration. It has been demonstrated that the longer the duration of the active period, and consequently the more pronounced the changes in the lymphatic structures produced by its lesions, the greater the liability to tertiary lesions of a severe type.

After the removal of the cells by fatty degeneration there is always a tendency to recurrence. This explains the difficulty of curing the disease at this period. This tendency is due to an increased injury to the lymphatic structures already greatly impaired by the lesions of the active period of syphilis. This impairment consists in the formation of fibrous tissues as a result of low inflammatory action mechanically set up by the cells. This fibrous formation, of course, interferes, in a measure, with tissue-nutrition in different localities by producing changes in the vascular walls.

A careful consideration of all the facts thus far presented leads to the conclusion that the various lesions and different degrees of severity of the phenomena of the so-called "tertiary stage of syphilis" depend upon (1) the amount of damage produced by the lesions of the active period of the disease and its duration, and (2) the constitutional condition of the individual independent of specific infection.

**LATE, OR SEQUELAR, NERVE AND BRAIN SYPHILIS.**—The nervous lesions of late syphilis are more severe, and the prognosis much graver, than in the case of the early nerve phenomena. The accumulation of neoplastic material in and about the delicate nerve-structures, occurring in late syphilis, is associated with and probably dependent upon: 1. The local damage inflicted by the lesions of the active stage in the form of a low grade

of inflammation with connective-tissue proliferation and vascular and lymphatic obstruction. 2. The debilitating effects of prolonged syphilization and the prolonged treatment necessitated by it. 3. Prolonged mental worry, with or without alcoholic or other excesses. 4. In some cases resistance to remedies occasioned by their prolonged use.

The main signs which suggest the condition are: Headache and vertigo; nausea and vomiting; optic neuritis; cranial-nerve palsies or paralyses; apoplectic attacks or more gradual attacks of somnolence or coma, with partial hemiplegia; irritability and general mental failures; polyuria and polydipsia; marked remittent character to all the symptoms and their changeability. A. E. Brownrigg (Boston Med. and Surg. Jour., Jan. 22, 1903).

It is probable that the nerve and brain lesions of the sequelar period act entirely by producing mechanical and nutritional disturbance, the syphilitic infection proper having long since become exhausted. The manifestations of sequelar nerve-lesion are many and various.

Paralyses—such as hemiplegia, paraplegia, and monoplegias of different kinds—are apt to occur, and are due either to localized deposit of syphiloma external or internal to the structures involved, or to diffuse interstitial deposits and proliferation of obstructive tissue. Gummy tumors may occur in the brain proper or its membranes or the latter may undergo a chronic thickening resembling chronic meningitis from other causes. The pathological results and symptoms produced vary with the location and function of the structure involved. Gummy deposits in and about the vascular walls interfering with the cerebral circulation are prolific causes of paralysis. Vascular degeneration is often the cause of those miliary aneurisms the rupture of which

is at the bottom of many cases of apoplexy and hemiplegia.

The various cranial and spinal nerves are likely to become involved in sequela syphilis. This involvement may be central, involving the brain origin of the nerve, with or without a greater or less degree of coincident brain-involvement, or it may be peripheral, affecting any part or all of the distribution of the nerve. As with the brain, the nerve-lesion may consist (1) of a circumscribed or diffuse gummy deposit; (2) of sclerotic changes produced (*a*) by lesions of the active period or (*b*) by sequela gummy deposit; (3) of destruction of normal tissue-elements.

There has been something of a controversy as to the influence of syphilis upon the spinal cord. It is well known that gummy infiltration and localized deposits with consequent paralysis occur in the cord, but the etiological relation of syphilis to locomotor ataxia has been disputed. Erb maintains that 61 per cent. of cases of locomotor ataxia are due to syphilis. Fournier claims a syphilitic origin in the "enormous majority of cases." In regard to this question the writer can only say that, while the statements of these authorities may be exaggerated, clinical experience seems to prove that quite a proportion of cases are due to syphilis.

The following statistics are based on a study of 214 cases of tabes (136 men and 78 women) from the neurological service of the Charité, in Berlin, in comparison with 600 non-tabetic patients (400 men and 200 women) from the same service: Of the tabetic men, 38.2 per cent. gave a conclusive history of syphilis, while, of the men with other nervous affections, only 7.75 per cent. gave a like history.

The non-tabetic men gave a history of chancre with symptoms following which were suspicious of syphilis in 1.5 per cent., while the tabetics gave such a his-

tory in 8.1 per cent. Of the male patients with tabes, 21.3 per cent., while denying the primary lesion, had suffered from such symptoms as would tend to a diagnosis of syphilis; of the patients with other nervous diseases only 4.5 per cent. had had such symptoms. In only 11 per cent. of the male cases of locomotor ataxia was there no evidence whatever of venereal infection, while 67.5 per cent. of the non-tabetics gave this negative history. The results with the women were practically the same. Of the tabes cases, 35.9 per cent. were surely syphilitics, 35.9 per cent. were suspicious, and 28.2 per cent. gave no evidence whatever of previous venereal disease. For the non-tabetic women the percentage in these three classes was 6.5, 10.5, and 80 per cent., respectively. Ernst Kuhn (*Arch. f. Psych. u. Nerv.*, '98).

From 15 to 25 of each 1000 persons affected with syphilis develop some specific disease of the central nervous system, exclusive of those who develop either tabes or general paresis. The greatest number of cases of cerebral syphilis result from mild and moderately severe forms of the disease. In 11 per cent. of cases of syphilis of the brain the cerebral symptoms have occurred within the first half-year after the initial affection, and in 24.6 per cent. of all the cases between 6 and 10 years after the primary sore. The brain and spinal cord are affected much more frequently than the peripheral nerves.

Syphilis of the central nervous system is characterized, above all, by the multiplicity of the symptoms and by the tendency to remissions and relapses. No set of symptoms is pathognomonic of syphilis of the brain or spinal cord. The presence of constitutional syphilis is more easily suspected and proved from the study of the pupils than from any other symptom that the patient may present. These pupil-changes are: (1) inequality of the pupils, one contracted and the other dilated; (2) unequal response, the one reacting to light, the other failing to respond; (3) the complete immobility of the pupils, both to light and during accommodation; (4) a marked departure from the circular form in cases in which



there has been no preceding iritis. Chronic forms of headache in an otherwise-healthy individual continuing for days, but often intermittent, possibly worse at night, dependent largely upon the position of the head, are of syphilitic origin. Vertigo is an early symptom. Single epileptoid seizures, transitory hemiplegias, and transitory motor aphasia occurring in the absence of renal disease are suspicious signs. Apoplectic attacks occurring in middle life in persons who have neither renal nor cardiac disease may be safely attributed to syphilis.

Ocular nerve-palsies of varying kinds are often among the earliest symptoms of tabes dorsalis, and it is questionable if some of these forms of tabes, beginning with ocular palsies, are not truly specific types of cerebro-spinal syphilis. Often brain-symptoms are associated with those pointing to disease of the lower or lowest portions of the spinal cord. Spastic or paralytic symptoms, which may be symmetrical, but often invade one side long before the other is diseased, are suggestive of spinal syphilis. The paralysis may last for years before it becomes complete. Sensory symptoms, if super-added, may remain slight. In pseudotabes syphilitica the disease often invades one leg long before it does the other. The ataxic symptoms are often very slowly developed, and it is just in these cases that the absolute immobility of the pupil, in contradistinction to the Argyll-Robertson pupil, gives good reason to believe that what is supposed to be tabes dorsalis is a syphilitic pseudotabes. Sachs (N. Y. Med. Jour., May 27, '99).

The prognosis of late nerve and brain syphilis is notoriously bad, but in many cases more hopeful than some authorities would have us believe.

**The Syphilides.**—The most prominent of the manifestations of syphilis are the eruptions of the skin. These are termed "syphilides," or "syphilodermata." The syphilides are many and various, often confusing; but their classification may be rendered quite simple; thus, if papules

are the essential feature of a syphilitic eruption it may be termed a "papular syphilide." In the same way the eruption may be designated as vesicular, pustular, tubercular, squamous, crustaceous, or ulcerative, and such combinations as papulo-pustular, papulous-squamous, and so on, the first part of the combined term corresponding to the feature of the mixed eruption that is most prominent. Ulcerative syphilides may be designated as superficial, deep, serpiginous, or perforative, as the case may be.

The principal distinctive lesions of syphilis that occur at various periods during its course are macules, papules, mucous patches, mucous tubercles, condylomata, vesicles, pustules, bullæ or blebs, rhagades or fissures, gummy tubercles, and diffuse gummy deposits and infiltrations. Dependent upon some of these lesions, different forms of deep and superficial ulceration, attended or followed by peculiarly-formed crusts and scars, may occur—syphilitic ecthyma and rupia—ulcero-crustaceous syphilides. Squamæ or scales in various forms and locations may develop.

**PHYSICAL CHARACTERS OF THE SYPHILIDES.**—The most important point in the study of the syphilides is their general characteristics. These characteristics are [Keyes]: (1) polymorphism of all lesions, including the chancre; (2) rounded form of the eruptive lesions and ulcers; (3) lividity or "ham-color," becoming coppery, then grayish, and finally white and shining as cicatrization occurs; (4) absence of pruritus and pain excepting in hairy regions, and, with respect to pain, in the bones; (5) symmetry, generalization, and superficial character of the early eruptions in all save precocious or malignant cases; (6) tendency to grouping of the later eruptions, which involve the true skin and tend to scar-

ring; (7) tendency to circular arrangement; (8) scales comparatively thin, white, generally superficial, and non-adherent; (9) crusts irregular, thick, and adherent, and either of a greenish or black color from admixture of disorganized blood; (10) abrupt edges of both skin and mucous ulcerations, which are not undermined, are sluggish, and bleed easily [the chancrous ulcer, it will be remembered, has sloping edges]; (11) the rounded, depressed appearance of cicatrices, which are thin, movable upon the sublying tissues, pigmented at first sometimes, but eventually becoming white and shining. These scars are often crescentic or horseshoe-shaped.

In addition to the foregoing special characters of the lesions of syphilis we have attendant symptoms, such as the so-called syphilitic fever in some cases, alopecia, headache, osteocopic pains worse at night, analgesia, anæsthesia, indolent lymphitis, iritis, sore throat, and mucous patches.

The term "polymorphous" is applied to the syphilides because there is no form of skin-lesion that may not occur in syphilis. Indeed, no single form or type of lesion is usually present: *e.g.*, a papular syphilide is rarely purely papular, vesicles, pustules, or erythematous patches being usually found at the same time, the eruption being named from the lesion that predominates.

**Prognosis.** — According to Bäumler, the infection of syphilis lasts from eighteen months to three years, after which it is exhausted. Following the cessation of this active period, the blood and the secretions of open lesions cease to be contagious, and it may also be stated that in by far the greater proportions of cases, especially if they have been properly treated, no further manifestations are ever experienced.

The prognosis as regards severity of syphilis varies with the habits and intrinsic resistance of the patient, and the assiduity with which treatment is followed up. There is no disease the duration and course of which are so uncertain as those of syphilis. It is impossible to state arbitrarily in any given case that the disease has or has not terminated. This is more especially true when we consider that it may permanently modify the constitution of the individual, even though no typical manifestations of the disease appear after a certain time. No method of blood-examination thus far suggested to determine the existence of syphilis has proved reliable.

The disease may manifest itself as a series of mild secondary eruptions followed by apparent recovery, or it may afford no evidence of its presence after the initial sore throat until late in life, when suddenly tertiary lesions—*i.e.*, sequelæ—crop out.

**Curability of Syphilis.** — Although it must be acknowledged that syphilis often causes a permanent modification of the patient's constitution, still the evidence shows that syphilis can be cured. The consensus of opinion is that it is a perfectly curable affection in by far the greater proportion of cases. We have proof of its curability in the cases of second attacks, cited by reliable authorities, and in the fact that, whatever the possibilities of tertiary lesions, they are not necessary and are undoubted sequelæ. Sequelar syphilitics may procreate healthy children, and the evidence tends to show that the blood and secretions of tertiary lesions are no longer inoculable. If the microbial character of syphilitic infection be admitted, the spontaneous tendency to cure of syphilis is almost beyond controversy. It is part of the life-history of the germ. The



prognosis of the disease as regards the life of the patient is a matter difficult to determine, as is obvious when the obscurity and wide variation in type of the more remote conditions produced by syphilis are taken into consideration. Fatal results from syphilis are usually incidental to sequelar lesions of the arterial or cerebro-spinal systems or the viscera. They occur, as a rule, at a period so remote from the original infection, and the symptoms are so obscure as regards the specificity of their origin, that it is practically impossible to determine the primary cause of the condition in a very large proportion of cases. This much may be said, however, namely: syphilis is a disease that is essentially benign so far as danger to life is concerned. It is probable that in well treated cases the average longevity is not seriously diminished by the disease.

In regard to the expectancy of life in syphilis, the following points are of value: 1. Inherited syphilis is one of the most fatal of all disorders affecting mankind, and under the most favorable circumstances, apart from abortion, 90 per cent. of children born living subsequently die. 2. Acquired infantile syphilis is rare, and is easily treated, and probably a large proportion of all infants so affected survive. 3. In acquired syphilis in adults between 80 and 90 per cent. escape gummata. The percentage of patients affected with gummata who die probably does not exceed 2 per cent. 4. The expectancy of life is probably not affected by the coincidence of syphilis with other diseases, and the prospect that the patient with acquired syphilis will ever suffer from struma, cancer, or tuberculosis is exceedingly small. 5. The natural evolution of acquired syphilis in untreated cases is not in the direction of a fatal issue, but rather in the line of physical degeneration due to involvement of the nervous system and the bones without affecting the organs essential to life. 6. It is unfair to charge an extra risk for the insurance of

syphilitic applicants otherwise in sound health. The syphilitic applicant for life-insurance should be examined with a view not so much as to his syphilitic history as to his condition with relation to all the other items making up a satisfactory risk. In other words, if he has a good family history, a sound constitution, excellent habits, and has reached but not passed a satisfactory age, his expectancy of life is probably that of other individuals in similar conditions without added risk on account of syphilis. Hyde (*Med. Examiner*, Apr., '98).

Syphilis seems to be especially amenable to treatment. In 145 adults, 65 per cent. only showed mild transitory lesions which left no trace; 26 per cent. showed no destructive lesions of any sort. Only 6 per cent. exhibited considerable severity for a time; even these finally cleared up completely, leaving no trace. J. A. McDonald (*Med. Record*, May 11, 1901).

The urine of syphilitics, far from being hyperacid, is, on the contrary, hypo-acid, and this hypo-acidity is but little diminished by a stay in the hospital; the acidity of the blood also suffers a considerable diminution; the mercurial cure, acting upon the body in general, and probably the liver in particular, increases the hypo-acidity of the urine, and consequently also the blood; finally, the mercurial cure, specifically for the syphilitic manifestations, is insufficient to bring on a complete cure, and it is necessary to combine with it a treatment acting upon nutrition in general and upon the nervous and hepatic functions in particular. E. Buffa (*Archives Inter. de Pharm. et de Thér.*; *Amer. Jour. Med. Sci.*, June, 1902).

**When may a Syphilitic Marry?**—Our best authorities assert that, on the average, marriage is safe at the end of three years. Fournier gives the following requirements for the guidance of syphilitics contemplating marriage: 1. Present freedom from specific symptoms. 2. Advanced period of the disease. 3. A considerable period of absolute freedom from symptoms since the last specific mani-

festation. 4. A mild type of the disease. 5. Prolonged and thorough treatment. These requirements contain in a few words all that is necessary for us to impress upon syphilitic patients who consult us with reference to their matrimonial prospects.

A society has been formed at Paris for "Sanitary and Moral Prophylaxis" composed of physicians, businessmen, officials, and others, the aim being an actual campaign against syphilis. Many practitioners now forbid marriage under four to six years of treatment. The new society aims to have a large representative membership from all classes and to utilize all measures in the campaign against syphilis and its great procuress, prostitution, education of the public in the dangers of venereal diseases, official regulation, medical prophylaxis by public evening dispensaries with private consultations and circulars of instruction and warning, besides measures of a religious and moral order.

Among the measures which the league is advocating is training of girls to some trade, the closing of saloons with private rooms, opening the liberal careers more freely to women, warning young girls of the dangers that threaten them, fixing "parental responsibility" and legal penalties for damages from venereal contamination. The public should be warned of the dangers of extragenital contagion. A. Fournier (*Semaine Méd.*, May 22, 1901).

### **Congenital Syphilis.**

**Acquired Syphilis in Children.**—Congenital syphilis should be differentiated from infantile syphilis in general. Children may acquire the disease independently of hereditary transmission. The course and phenomena of acquired syphilis in children are in nowise different from the same affection in the adult. Children may become inoculated with syphilis by kissing persons with oral or labial chancre, mucous patches, fissures, or ulcers, or it may acquire it by nursing its syphilitic mother or nurse.

The medico-legal question of the infection with syphilis of the nurse by the nursling may be difficult and have pitfalls for the unwary. In examining the nurse the discovery of a chancre in a position in which contagion from the child is possible is all-important. If a sore is present its induration and the existence of an indurated axillary bubo must be especially noted. If there is no sore, relics are to be looked for—a macula which is constant, but lasts only for a few weeks; a cicatrix which is apparent in only two or three out of ten cases; induration which lasts for several weeks, and in the case of neoplastic-like chancres for periods up to five months; and a bubo which always remains for a certain time. The genital organs must be carefully examined and mucous patches in the form of papules or erosions must be distinguished from chancres, the presence or absence of buboes being especially noted. In examining the child the first point to be determined is: Is the syphilis acquired or congenital? In establishing the latter alternative the absence of chancre must be first ascertained. Next the period at which the secondary symptoms became manifested is to be noted. Every case in which secondary symptoms occur in the course of the first two months of life is congenital.

This rule is proved mathematically. Suppose that a child contracts syphilis on the day of its birth. The incubation period of chancre is three weeks at least—say, twenty days. The second incubation period averages about forty-five days—say, forty days;  $20 + 40 = 60$ . Therefore the secondary symptoms of acquired syphilis cannot appear before sixty days (two months). Again, the presence of lesions peculiar to congenital syphilis will decide the question—coryza, pemphigus, epiphyseal dislocations, marasmus, and cranial and nasal deformities. The examination of nurse and child being completed, the relation of the disease in one to that in the other is to be considered. There are three possibilities. Either may have contracted the disease from the other or the attacks may be independent. The previous con-



dition of the nurse should always be investigated, her child and husband (if there is one) should be examined. The condition of the former is of the highest importance. Immunity is an almost absolute proof of immunity of the mother. Syphilitic women may, with rare exceptions, beget apparently healthy children, but scarcely with recent secondary syphilis present. Next the priority of disease in nurse or child must be ascertained if possible. When there is hereditary syphilis of the child, previous immunity of the nurse, her infection by a mammary chancre which is in such a stage that it could have been acquired in the lactation being determined, the practitioner is not justified in swearing that her syphilis must have been acquired from the child. All that he should say is that there are reasons which authorize the belief that the nurse could have acquired syphilis from the child. There may be other sources. Fournier (Lancet, Jan. 22, '98).

While it is the rule that a baby with hereditary syphilis does not infect its own mother, there are exceptions to this rule. However, their occurrence is so rare as to "prove the rule." The baby should not be taken from its mother's breast, but the mother should be warned and should be kept under observation. A syphilitic element often underlies cases of malnutrition which manifest themselves in many children, even of well-to-do parents, by feeble vitality and poor development of muscle and bone. All the usual hygienic and climatic measures will often fail to improve these children, though they will thrive when given anti-syphilitic treatment. It is often necessary to repeat this medication at intervals up to puberty. So-called cases of retarded syphilis are really examples of an improperly treated syphilis of childhood reappearing years afterward, perhaps not until the age of twenty or thirty. Such late developments can be prevented by a sufficiently long course of specific treatment in early life and occasional inspection for several years afterward. A. Jacobi (Pædiatrics, March 15, 1902).

The possibility of acquiring the dis-

ease by vaccination must also be remembered, although non-humanized virus is now almost exclusively used, and such an accident can only occur through carelessness. There is also the possibility of contamination through criminal assault. Such cases have no bearing upon congenital syphilis, save that great care is to be exercised in differentiation.

It is held by many that either parent may transmit syphilis to the child, although, so far as the father is concerned, the question to procreate a syphilitic child without first infecting the mother is still *sub judice*. The presence of the syphilitic microbe is probably incompatible with the life of the spermatozoa; but, until the germ of syphilis has been absolutely demonstrated, we can only claim theoretically its necessity in this particular method of transmission. The most plausible view is that, while the presence of the syphilitic germ is necessary in order that the semen should be inoculable, its presence is unnecessary in order that the father should impress the foetus with conditions which, while not specifically syphilitic, are none the less derivatives of that disease.

If the syphilitic virus gained entry into the unsegmented human ovum, its effects would lead to the destruction of the ovum. Foetal syphilis must originate at a later date, and, although syphilis in the parents may doubtless have its effects upon the ovum and spermatozoa of the same, and lead to constitutional disturbances in the offspring, progressive syphilitic lesions, the true syphilomata, in the foetus and infant are *not* inherited, but are congenital; that is to say, acquired *in utero* after conception. If the mother be without sign of syphilis, and the child be syphilitic, the only satisfactory explanation is that the syphilitic virus has entered into the maternal organism and tissues, and has failed to induce any characteristic lesion at the point of entry, but has, through

the placenta and chorionic villi, gained an entrance into the foetal tissues; the process arrested in the mother has been developed in the susceptible tissues of the child, and there is here an example of the variability in the manifestations of the disease dependent upon the reactive powers of the tissues. A further word in support of this contention is found in the significant way in which the liver is affected in congenital syphilis. Extensive specific lesions of the liver in the acquired disease are relatively uncommon. They are the most common of all lesions in the congenital affection. Were the ovum infected it would be difficult to explain why the liver should thus be especially singled out. This organ is the first to receive the blood coming by the umbilical vein; then, if the infection originates from the placenta, hepatic implication is the natural sequence. The essential difference between such congenital, or antenatal, and "acquired," or post-natal, syphilis is that in the former the virus passes immediately into the blood, and so becomes disseminated through the organism, while in the latter the dissemination is delayed. The second stage of acquired syphilis is the first stage of the congenital disease. J. G. Adami (Canadian Pract., July, '98).

The father's sperm cell may contain the syphilitic virus and convey it to the child without participation of the mother. The maternal generative cell may contain the virus and result directly in a diseased foetus. The placental circulation permits the passage of the infectious matter either way from mother to child, and *vice versa*. Several or all of these factors may combine, and the more of them that are present the less probable the escape of the child. The probabilities of the transmission of syphilis through the mother are greater because of more ways of possible influence on the foetus. The writer considers the probability of the appearance of hereditary syphilis to be reservedly proportionate to the time of infection of the parents, and to the length and thoroughness of the specific treatment. As to whether or not syphilis can be

transmitted to the second generation, we must have positive evidence (1) of acquired syphilis of either, or of both, of the grandparents; (2) of hereditary syphilis in either of the parents with the absolute proof that no new syphilitic infection of the parents took place, and (3) of hereditary syphilis in the grandchildren. A. Schalek (Journal American Medical Association, May 16, 1903).

**SYPHILIS HEREDITARIA TARDA.**—In a series of lectures at the Hôpital Saint-Louis, Fournier called especial attention to late hereditary syphilis. He reports some interesting cases in support of his view that the first manifestations of hereditary syphilis may be after the period of infancy, and even during the period of adolescence.

**Lesions of Congenital Syphilis.**—If not present at birth, lesions of various kinds develop from time to time. The writer has delivered children with a well-marked roseola. Chaps and excoriations of the quasimucous surfaces about the genitals, anus, and mouth are apt to develop, and may form true mucous patches or even condylomata. A "scalded" appearance of the anus is quite characteristic. "Snuffles" develop after a time, and the nares become so obstructed that respiration and nursing are interfered with and nutrition still further impaired. Ozæna may develop and lead to necrosis of the nasal cartilages. There is no symptom of hereditary syphilis so characteristic as snuffles. Caution is necessary in diagnosis, however. A great number of young children, especially in such climates as that of our lake-region, are affected with catarrh or coryza that presents an excellent imitation of syphilitic snuffles.

A livid macular eruption is sometimes seen, and ulcerations may form about the mucous orifices. Papular and pustular lesions are not infrequent, and sometimes



quite characteristically affect the palms and soles. Subcutaneous tubercular lesions may be seen in a few cases.

A very peculiar eruption occasionally occurs in syphilitic children that is identical in its physical characteristics with ordinary pemphigus in the adult. This "infantile pemphigus" is an unmistakable evidence of syphilis. It consists of an eruption of bullæ sparsely distributed over the skin. Sometimes but one or two blebs are present. It is especially apt to affect the palms and soles. The blebs are filled with fluid varying from slightly-turbid serum to pus, and is sometimes bloody. When the cuticle ruptures, the fluid dries into a greenish crust and ulceration occurs beneath, as in syphilitic ecthyma, or rupia.

The epithelial appendages of the body, such as the hair and the nails, are not so likely to become affected in congenital syphilis as in the adult, but a brittle, lustreless condition of the nails is occasionally noted.

Taylor has called especial attention to lesions of the bones in congenital syphilis. He has shown that the most frequent seat of the osseous lesion is the diaphyso-epiphyseal junction of the long bones, certain bones being affected with especial frequency. The possible dependence of certain cases of rickets upon hereditary syphilis is a question which, although as yet *sub judice*, is of the greatest interest and importance.

The most important manifestations of hereditary syphilis are the lesions of the viscera. Any or all of the viscera may be involved, the connective-tissue changes being especially apt to affect the liver, spleen, and kidneys.

The broad features characterizing the syphilitic manifestations in the infant's liver are: 1. Syphilis may lead to the granulomatous deposits in the organ or to interstitial fibroid changes.

2. The specific granulomata may be present either in the form of minute multiple miliary gummata or of isolated larger gummata such as, in general, are regarded as being of tertiary nature.

3. It is not possible to regard the one form as secondary, the other as tertiary, for either may exist with cutaneous disturbances of the secondary type.

4. By analogy, the interstitial fibroid change, so common in infantile syphilis, would appear, in the main, to be secondary to a degeneration and necrosis of the hepatic parenchyma, induced by the action of the toxins of the syphilitic virus upon the individual liver-cells. In part it is developed in direct association with the development of miliary gummata.

While the changes seen in the adult and infantile syphilitic livers are etiologically and anatomically identical, they may present differences, due, in part, to their relative duration, in part, to the reactive powers of the hepatic parenchyma at different life-periods. J. G. Adami (N. Y. Med. Jour., Apr. 22, '99).

Notes have been made on 100 post-mortem examinations of congenital syphilis, and the principal results of this investigation are as follow: The liver is always enlarged in the mature and immature foetus suffering from syphilis, whereas in children who have lived for a short time this enlargement is often absent. In the cell accumulations of diffuse and miliary syphiloma of the liver certain cell groups are to be differentiated: the cells either resemble proliferating epithelium or else they approximate to newly-formed blood-cells. Both these varieties are seen in the normal foetal liver; they disappear, however, either shortly before or after birth. This proliferation of epithelium is increased in syphilis. The liver is the chief blood-forming organ during foetal life; the young nucleated blood-cells originate from the endothelium of the walls of the capillaries; they are more numerous in the efferent than in the afferent blood-vessels. The vessels of the portal system in the foetus are peculiarly rich in cells of an "adenoid lymphoid" character, which begin to resemble the adult variety

at birth. The kidneys in the syphilitic foetus are considerably enlarged; after birth they diminish in weight. The kidney changes in congenital syphilis are constant; they consist chiefly in an infiltration of the cortical blood-vessels, which after some time cause atrophy and degeneration of the epithelium of the urinary tubules and glomeruli. The kidney shares, to a slight extent, in the elaboration of the foetal blood. The syphilitic splenic tumor is constant in the foetus. The usual pathological lesion is a small-celled infiltration of the large and medium-sized blood-vessels. The foetal pancreas shows an increase of weight in the syphilitic subject. The thickened coats of the umbilical vessels without infiltration is no sign of syphilis. The umbilical vessels in congenital syphilis often show specific changes, and their recognition during life would help in diagnosis. In syphilitic disease of the thymus, in addition to the formation of abscesses, the connective-tissue septa become thickened, causing compression of the lobules. Wegner's syphilitic bone disease is not always present, but the condition is never seen in non-syphilitic infants. Clinically the syphilitic infant has almost always some disturbance of the functions of the kidney. Hecker (Deut. Archiv f. klin. Med., vol. lxi, pp. 1 and 2, '99).

There is in syphilitic newborn children a marked tendency to apoplectic effusions in various situations, particularly in the meninges of the brain and probably also the cord.

In 62 dead children microscopical examination showed that 26 per cent. were positively non-specific, 53 per cent. were syphilitic, and 9.7 per cent. were doubtful, no result being obtained in 11 per cent. The kidneys were involved in 90 per cent. of cases, the spleen in 61 per cent., the thymus in 50 per cent., the pancreas in 46 per cent., the bones in 43 per cent., the liver in 23 per cent., the lungs in 17 per cent., and the umbilicus in 16 per cent.; hence, the kidneys most constantly show pathological changes, while these are comparatively uncommon in the lungs and liver, largely because the

latter organs become macerated so easily that the changes are not recognizable. The frequency of syphilitic changes in the spleen and thymus emphasized. Osteochondritis was found in only half of the cases, and is pathognomonic. R. Hecker (Deutsche med. Wochen., Nov. 6, 1902).

The permanent teeth in congenital syphilis are irregular, notched, and pegged, and the conformation of the alveolar arch is imperfect. The two upper central incisors are "Hutchinson's test teeth." These are short, vertically notched, narrow, and rounded at their corners.

Interstitial keratitis is practically pathognomonic of inherited taint, and, when coincident with the syphilitic type of teeth, puts the diagnosis beyond doubt.

**Treatment.** — Syphilis has long been treated upon the theory that it can be antidoted by drugs. Much harm has resulted from this. A rational therapy of the disease must necessarily comprehend a knowledge of its natural evolution and conform to its natural course. The aim should be, not to stamp out quickly the disease, but to combat its *materies morbi* and reinforce the spontaneous tendency to removal of its results, until the system triumphs and the disease is finally eliminated.

Notwithstanding modern progress in therapeutics, mercury is still our sheet-anchor in the treatment of syphilis. The slow, continuous, and moderate use of mercury, for a period corresponding to the maximum time of the normal duration of the disease as nearly as may be, *without at any time producing its full physiological effects*, will generally bring about a cure that can be accomplished in no other way.

It is well known that mercury has the power of inducing fatty degeneration and



elimination of inflammatory products, or "of relieving tissues encumbered with superfluous and obstructive material." This condition of the tissues is precisely what exists in syphilis, and as mercury is the best remedy at our command for the correction of such a pathological state, irrespective of etiology, it should be administered throughout the natural course of the disease, not to antidote a poison, but to remove the morbid results produced by it, as fast as they are formed, until finally the syphilitic impression upon the organism has naturally exhausted itself. We have already seen that the infection of syphilis, whatever its material substance, practically consists in the influence of infection on healthy cells, causing their rapid proliferation and obstructive accumulation. That the peculiar property of the infection is due to a pathogenic microbe of as yet unknown form is probable; but whether the morbid principle be a germ, virus, or "degraded cell," the result is the same. It is a rather peculiar fact that every method of treatment for syphilis that has been advocated for the last two or three centuries has comprised such measures as tend to produce rapid tissue-changes, and, more especially, elimination. The sweating cure; the use of hot baths, as at the Hot Springs of Arkansas; the purgation and starvation cures, Boeck's method of syphilization, and the treatment by pustulation with tartar emetic, all of which have been recommended by various authorities at different times, are chiefly active through their power of inducing fatty changes in the tissues. In the various methods of hydrotherapy the benefit is secured by increasing elimination. This is especially important in view of the toxins elaborated by the microbe of syphilis.

The action of mercury upon the blood

is of great practical interest, inasmuch as by its use diametrically-opposite effects may be produced, according to: (1) the doses used, (2) the duration of its administration, (3) the constitutional condition of the patient, and (4) the stage of the disease. (See MERCURY, volume iv.)

The writer divides the remedial procedures into (1) the secondary incubation or pre-eruptive period; (2) the eruptive stage, including the first six or seven months; (3) from the sixth or seventh month to the end of the third year—the late secondary stage; (4) the tertiary stage. The administration of mercury cannot be begun too early, and when the round cells, caused by the syphilitic virus, are still young and more easily acted upon, iodide of potassium is administered for the elimination of the degenerated round cells and the toxins of syphilis. The mercury is given in  $\frac{1}{8}$ - to  $\frac{1}{4}$ -grain (0.008 to 0.016 gramme) doses, three times daily, while an inunction of 50-per-cent. strength should be rubbed into every portion of the body, especially between the fingers and toes, as well as on the palms and soles. W. D. Trenwith (Medical News, April 25, 1903).

If the drug be given in a less vigorous fashion for a longer period, pallor and debility may result, due to depreciation in the quantity and quality of the red blood-corpuscles, defibrination of the blood-plasma, and increased tissue-waste. A certain degree of these effects is unavoidable in the treatment of syphilis; but it should be our chief aim to keep them within bounds, and thus avoid the danger of producing permanently injurious effects. Such effects as great pallor, wasting and debility, pustular or vesicular eruptions, with fever known as "mercurial fever" and marked tremors, may result from the action of mercury, and that, too, without the occurrence of ptyalism: the characteristic effect of large doses of mercury. On the other hand,

small doses of mercury, in various cachectic or anæmic conditions, particularly during the sequelæ of syphilis, stimulate hæmatogenesis and rapidly and markedly increase the quantity, while improving the quality of the red corpuscles and fibrin, thus lessening hydræmia.

Iodine is another remedy that experience has shown to be curative in syphilis, and is second only to mercury. Iodine, in the form of the iodides, especially, is invaluable, more particularly in late syphilis. The iodides—of which potassium iodide is the type—act in two ways in the cure of syphilis, viz.: first, by their own intrinsic power of producing fatty degeneration and elimination of morbid products, especially toxins; and, secondly, by liberating, exciting to renewed activity, and eliminating the mercury that is stored up in the tissues, thus assisting its action. It is evident that the first of these effects is the most important, for the iodides have a most powerful effect in resolving the products of inflammatory changes or adventitious deposits, irrespective of their cause. This, in the face of the argument that iodine can cure syphilis only by liberating mercury from the tissues, and that it is the mercury, and not the iodides, that produces the curative effects. That this is incorrect is shown by the beneficial effects of the iodides in late syphilis when mercury has never been administered.

It is the writer's opinion that treatment should begin as soon as the diagnosis is established. The duration of the initial lesion is thereby shortened, and secondary symptoms moderated, if not prevented. To save the patient from lesions upon the body or face is desirable, and only to be accomplished by early treatment.

The mildest and least irritating form of the drug is the mercurous iodide: the

green or protiodide. It is best given in pill form, beginning with doses of, on the average,  $\frac{1}{5}$  grain, thrice daily. This dose is to be continued for several days, and then increased one pill per day—still in divided doses—until the gums become slightly tender or the stomach and bowels disturbed. The writer generally gives the drug until the gums are slightly affected, and then gradually lessens the dose until the patient is taking about half the amount necessary to produce slight physiological effects. This, as Keyes terms it, is the patient's average dose, and is usually from two to four pills, of the strength mentioned, daily. This should generally be continued—with certain intervals of rest—throughout the course of treatment. It is often well to substitute from time to time some of the other mercurials for the mercurous iodide.

It is the physician's duty to tell his patient that if he wishes to get well he must take remedies for at least three years, and if any doubt exists at the end of that time he had best add another year, especially if he has matrimonial intentions. As already stated, no syphilitic patient should be permitted to marry under three years from the appearance of the chancre. In the case of women a still longer period is advisable.

In the event of pregnancy, when the father is syphilitic at the stage when the disease may be transmitted, and when the mother is healthy, two classes of cases are considered: (1) when the pregnancy is the first one, supervening shortly after marriage; (2) when several previous pregnancies have resulted disastrously in abortion or in early death of the child. The child can be safeguarded by antisiphilitic treatment of the mother, even when she is healthy. The cardinal points of treatment are that the treatment should be begun as soon as possible after the onset of pregnancy, and that mercury is the best



drug to administer. If the iodide is given in conjunction with mercury, all the better. Inasmuch as it is not an adult, but the foetus, that is being treated, small doses should be given. The treatment should be continued during the whole time of pregnancy. Fournier (*Sem. Méd.*, Nov. 30, '98).

Influence of the treatment of syphilitic mothers on the fate of the foetus. The claim that mercury has a local action on the uterus is justified. In the 33 cases there were only 1 abortion and 3 premature labors in the eighth and ninth month, while abortions occurred in 22 per cent. of the cases under Fournier's treatment. The number of stillbirths was 6 per cent., compared with 23.4 per cent. in Löwy's statistics of treated cases; the number of children who showed signs of syphilis was 21 per cent., compared with 89 per cent. in Fournier's experience. Still better results may be expected if treatment be begun at the beginning of pregnancy instead of at whatever period the women happened to enter the hospital. Riehl (*Wiener klin. Wochen.*, June 27, 1901).

A difficult item in the management of most cases of syphilis is convincing the patient that it is necessary for him to avoid the use of liquor and tobacco for an extended period, and that he must abstain from the various dissipations and excesses to which he has been accustomed. This point must be insisted upon, however; and, with good conduct upon the part of the patient assured, half the battle will have been gained.

A large number of those under treatment for syphilis and other venereal diseases have seriously impaired the efficiency of the British navy and army. In 1880 for primary syphilis, 32,223 days were lost; for secondary syphilis, 128,059; for gonorrhœa, 40,392. The figures for 1897 were: for primary syphilis, 96,335; for secondary syphilis, 49,764; for gonorrhœa, 77,054. Intemperance is undoubtedly responsible for a large percentage of the cases, so that anything which can diminish the amount of intemperance will cause a decrease in

the number of cases of venereal diseases. Good naval barracks should be substituted for depot-ships, advice should be given to young sailors as to personal cleanliness, early marriages should be encouraged, and preference should be given to healthy people in making appointments. E. E. Mahon (*Brit. Med. Jour.*, Aug. 19, '99).

In some cases mercurial inunctions or mercury-vapor baths must be wholly depended upon. Both are very efficacious in obstinate skin-lesions. The general dissemination of mercurous vapors over the surface of the body explains, in great part, the beneficial action of inunctions.

Welander has recommended a method of using mercurial ointment in syphilis which has many advantages over inunction. It consists in the wearing of a sort of apron covered with the ointment. A piece of gauze or flannel, 20 inches long and 16 inches wide, which is fastened with tapes about the neck and waist, is spread daily or every few days with from 1 1/4 to 2 drachms of gray ointment. The cloth can be worn on the chest or back. The patient remains from ten to fourteen hours in bed, but wears the cloth also during the day. The ointment is spread by the patient himself. The method rests on the old theory of Gerhard, that the "inunction cure" is nothing else than an "inhalation-cure." Welander's method has been personally employed in 102 cases of recent and old lues. The time required to obtain results was about that needed in other methods, but the new procedure has the advantage of simplicity and cleanliness over the inunction-treatment, and of the absence of pain, and of convenience over injections. These patients were directed to spread daily for three weeks 1 1/4 drachms of ointment on flannel or gauze, and during the spreading to bend as low as possible over the cloth, and to consume at least ten minutes in the spreading of the ointment. In the next three weeks the cloth is spread every two days. C. Stern (*Münch. med. Woch.*, Feb. 7, '99).

Thirty patients treated with mercuriol, a new preparation of mercury. Mercuriol is a preparation in which the mercury

is reduced to very fine particles, and is free from the objection of aggregating into large masses.

The method is based on the fact that mercury easily amalgamates with aluminium or magnesium, from which it can be separated by the addition of water, forming a hydrate. Mercuriol contains from 40 to 80 per cent. of metallic mercury in fine amorphous particles. When exposed to warmth, air, and humidity, the aluminium and magnesium are oxidized, and mercury set free. Mercury was found in the urine in all the 30 cases. The method used was that of Welander, where the drug is put in a woolen bag worn next the skin.

One and one-fourth drachms of mercuriol were used daily for the first five or ten days; afterward every second day. The duration of treatment varied from thirty to forty days. This method is better and more cleanly than inunction. Ahman (Arch. f. Derm. u. Syph., Apr., '99).

In syphilitic diseases of the brain and nerves the patient should be mercurialized as soon as possible, and it is best to do this by inunction. Iodide of potassium should be given in fairly large doses. Sixty grains should be given during the day, this dose doing as much good as if 90 or 120 grains were given daily. The main point is to get the patient under the influence of mercury as soon as possible. James Taylor (Clin. Jour., May 3, '99).

Inunctions are useful in all stages. This method is the safest of all. The blue ointment of the United States Pharmacopœia is the best preparation. The best time for treatment is the hour of retiring, in a room at an even temperature. The early treatment—that is, prior to the secondary eruption—is of no value. The ideal end of treatment is to stop when the disease is cured. The cases of reinfection frequently reported are probably no cases of reinfection, but the remanifestation of the old condition, or due to failure in absorption. The chronic intermittent method of treatment has no advantages over the symptomatic plan of treatment. B. Lapowski (N. Y. Med. Jour., May 6, '99).

The treatment of syphilis must be long continued, for eight months or one year, and it is certain that most of the cases in the British navy and army do not receive treatment for nearly so long as this. By the intramuscular method treatment may be continued as long as necessary after leaving hospital, the men coming up for treatment once a week. Twenty thousand injections have been personally given with only 1 bad result, and in that case an abscess formed. The following prescription is preferred, as it causes but little pain—1 drachm of mercury, 2 drachms of lanolin, and 4 drachms of carbolic oil (1 in 20); of this 10 minims are injected into the buttock. Major F. J. Lambkin (Brit. Med. Jour., Aug. 19, '99).

In using inunctions the patient should first be instructed to take a bath at 100° F., and then sponge himself with a 2-per-cent. solution of carbolic acid. After having divided the body into the following 11 subdivisions, namely: 1 and 2, the arms, palms, and axillæ; 3 and 4, the legs and soles; 5, the neck and head; 6 and 7, the breast and abdomen; 8 and 9, the thighs, with groin and Scarpa's triangle; 10 and 11, the back from the seventh cervical vertebra to the lower part of the gluteal region. One or two of the parts should be selected for friction, and from 40 to 60 grains of freshly-prepared and well-triturated blue ointment used for each inunction. If one employs a rubber other than himself, he should anoint the hands with a simple cerate in order that he may not absorb any of the mercury. If the patient's condition and *physique* are such as will permit, he should take 2 or possibly 3 Turkish baths a week. From 50 to 100 inunctions may be given with proper intermissions, and then they may be stopped for a shorter or longer interval, as indications and conditions require. In women taking this treatment, tonics should at the same time be given. Fumigation treatment is not to be followed as a routine plan. The patient is enveloped in blankets, India rubber or Mackintosh covering lined with flannel and tight fitting around the neck, and calomel, 20 to 40 grains, with a Maury or Lee lamp used to volatilize the salt



and generate steam at the same time. They should never be taken after meals, but preferably at bed-time, the patient at once retiring, if at all possible. The time consumed, as in the inunction treatment, is thirty minutes. R. R. Campbell (Hot Springs Med. Jour., Pt. 15, '99).

A permanent mercurial plaster, containing mainly calomel, for the treatment of infantile syphilis, has many advantages. The digestive tract, even in the youngest and most delicate child, is not disturbed; the absorption continues constantly, and is not limited by carelessness or forgetfulness of attendants; the medication can be withdrawn at will. M. H. Gillet (Jour des Prat., Sept. 29, 1900).

The tincture of iodine used in syphilis, giving it in 10- to 30-drop doses in coffee or red wine three times a day. In 26 per cent. of the patients the maximum dose that was well tolerated was 50 drops three times a day. Richter (Versam. Deutscher Natur. u. Aerzte, Sept., 1901).

It is sometimes necessary to bring a patient under the influence of mercury very rapidly: *e.g.*, in cases of syphilitic iritis, in which a few hours' delay might be fatal to the integrity of the eyes. In such an event calomel, in doses of  $\frac{1}{12}$  grain every hour, will accomplish the desired result. If necessary, ptyalism can be produced in this manner within twenty-four to forty-eight hours.

Another rapid and efficacious method is Lewin's method of hypodermic injection. From  $\frac{1}{16}$  to  $\frac{1}{8}$  grain of mercury bichloride, in combination with  $\frac{1}{30}$  grain of morphine and a small quantity of sodium chloride, is dissolved in 15 minims of distilled water, and injected into the cellular tissue, preferably of the buttock, once or twice daily; a minute dose of cocaine may be advantageously combined with the injection.

Taylor advises a mixture of calomel and sodium chloride, 5 parts of each, suspended in 50 parts of distilled water. Of this fluid an ordinary hypodermic sy-

ringe may be injected every eight or ten days. The sides of the buttocks and the back beneath the shoulder-blades are the best sites for the injections.

Eighty-four cases of syphilis were treated by the intravenous injection of cyanide of mercury. The arm is rendered aseptic by washing with a solution of carbolic acid; a rubber tourniquet is applied to the upper part of the arm to make the veins stand out. A fine needle of an hypodermic syringe, containing 20 minims of a 1-per-cent. solution, is then introduced into the chosen vein in the direction of the blood-stream. The tourniquet being removed, the fluid is injected into the vein, the needle is withdrawn, and an antiseptic swab applied to the point of puncture for a few minutes. Such an injection is repeated every morning, unless some contra-indication exists. In the eighty-four cases treated in this manner, the complications met with were very slight and rapidly disappeared. All the cases with but one exception showed very marked and rapid improvement. The average stay in the hospital per case was 23.2 days. In the worst cases other adjuvants, such as cod-liver-oil, iron, and correct diet, were resorted to. In all cases special attention was paid to the general health. In the tertiary and some of the rupial cases the iodides of sodium and ammonia were used. All cases on being discharged from the wards were advised to undergo a further and prolonged course of the ordinary methods of treatment in the outpatient department of the hospital. Arthur Chopping (Lancet, Feb. 18, '99).

The direct introduction of mercury into the blood exercises a most useful influence and improvement takes place almost at once. Small doses should be given at first and gradually increased. Lindstroem (Presse Méd., May 18, '98).

Injections of sublimate, 1-1000 to 1-5000, into a vein are safe. The injections are out of place in persons affected with sclerotic blood-vessels. Condylomatous syphilitic manifestations readily yield to this method, and their disappearance is more prompt than after subcutaneous injections of sublimate. No

toxic effects have been noted, either in the mouth or intestines. Relapses are more frequent than after the hypodermic method. The intravenous method is not recommended for general use, but is indicated in cases of intolerance toward other methods. A. Lichatchew (*Vratch*, xxii, No. 44, 1901).

Injections of calomel in the treatment of syphilis were first given in 1864. In 1883 this method was attempted again. Even Fournier, in 1896, advised it for severe phagedenic chancre of the tongue, malignant syphilis, tertiary sclerotic glossitis, severe laryngitis, and obstinate tongue affections. It has also been used in iritis, galloping syphilis, etc., with varying success. The dose may reach  $1\frac{1}{2}$  grains. But these injections cause unpleasant effects, fever, erythema, stomatitis, nephritis, enteritis, and, finally, all the symptoms of mercurial poisoning. The writer concludes that this method of administering mercury in syphilis is dangerous and is only indicated in exceptional cases, in which all other less severe methods have failed. E. Lesser (*Die Therapie der Gegenwart*, Jan., 1903).

For females with very weak stomachs, and in children, the gray powder or hydrargyrum cum creta is an excellent mercurial preparation.

It is an almost universal custom to use iodine and its preparations only in the late periods of the disease, and chiefly in tertiary lesions; but it will be found also that in many cases of obstinate secondary lesions they will not yield until the iodides are given. It is well to give a few weeks' course of the iodides from time to time, throughout the course of mercurial treatment. A small amount of the nascent mercuric iodide may be given at the same time if thought best. In precocious syphilis, in which destructive skin and mucous lesions or nerve-changes come on early in the disease, the iodides are sometimes our chief reliance. It is in late syphilis, however, that the iodides will

be found most reliable, especially if combined with mercury in the form of "mixed treatment." Gummy lesions require an excess of the iodides; but, in all cases after the lesions are under control, a prolonged mild mercurial course should be instituted. This is the proper method of treating the deeper lesions of the brain, spinal cord, bones, viscera, and testicle, tubercular lesions of various kinds; the various scaly eruptions; and those later syphilides that tend to aggregate themselves in groups or become particularly obstinate.

NEW REMEDIES FOR SYPHILIS.—There is a tendency on the part of the profession to recommend various new and questionable preparations in the treatment of syphilis. Certain vegetable preparations have enjoyed a more or less long-lived popularity. Sarsaparilla was long thought to be a specific. Among the new preparations are cascara amarga, berberis aquafolium, and stillingia, alone or in combination. A trial of these things demonstrates their unreliability, and shows more plainly than ever the value of iodine and mercury. As bitter tonics the vaunted vegetable preparations are all more or less useful, but as specifics they are arrant humbugs.

LOCAL TREATMENT OF THE CHANCRE.—Important in this connection is (1) to avoid caustics, (2) to avoid grease, and (3) to keep the parts as dry as possible and perfectly clean. Another important point in the management of severe chancre is the maintenance of rest. Movement and friction are often responsible for serious complications of chancre. That sexual intercourse should be interdicted goes without saying.

The only exceptions to the rule regarding caustics are mixed sores, with a minimum of induration, and exulcerated sores that become sluggish and refuse to



heal after induration has nearly or quite disappeared. In the first instance pure carbolic acid followed by fuming nitric acid is admissible, but the galvanocautery, preceded by cocaine, is better. In sluggish ulcers stimulation with silver nitrate may be warrantable.

The old-time black and yellow washes are serviceable, although the part cannot be kept dry under their use. A solution of mercuric chloride, 1 to 1000, is very useful. A plan recommended for the application of the bichloride is to wash the lesion with a weak solution of common salt. Calomel is now sprinkled upon the part, a small amount of nascent and active bichloride being thus formed. The writer has used this plan for condylomata quite successfully. The best absorbent for the dry treatment is the powdered oleate or stearate of zinc. Simple calomel is also serviceable.

The following local treatment for soft chancres has proved very successful in many cases. The ulcer and the surrounding skin is first washed over with soap and water, and then with perchloride lotion. After this the chancre is frozen with chlorethyl, and the superficial layer of the chancre is removed with a sharp razor. The hæmorrhage is controlled by touching the raw surface with a stick of nitrate of silver. The wound is covered with iodoform powder, and a zinc-oxide plaster is applied. This plaster should be renewed every twenty-four hours. The treatment is usually continued for four or five days. Unna (*Monats. f. prakt. Derm.*, 26, 6, '98).

Sodium sozoiodolate is of great value in soft chancre. It is quite free from smell, and is not poisonous. At first it should be mixed with some inert power and it is apt to cause a smart burning pain when applied, but after a few days the affected part grows less sensitive, and the pure preparation may be applied freely. Grivzoff (*Berl. klin. Woch.*, No. 50, '99).

Reports based on fifty cases of syphilis, most of which were seen at the beginning

and kept under observation for from twenty to forty years. No case is included in which less than sixteen years had passed since the last symptoms. They show that syphilis is curable in all its stages, but it is in the secondary period that a cure is most frequently obtained. While mercury and iodide of potassium are the main factors in the cure, there are others which assist: *i.e.*, a robust constitution and an absence of hereditary or acquired taint of any kind. The natural power of resistance, which varies in each organism, is also an important factor. V. M. Tarnowski (*Russki Arkhiv Patologi*, etc., Jan. and Feb., 1900).

In all forms of tertiary syphilis of the pharynx the combination of iodide of potassium internally and mercurial inunction is especially useful, and should be employed at the earliest possible opportunity. In tertiary ulceration a good deal may be done locally to arrest the disease and to promote healing. The surface of the ulcer should be carefully cleansed and insufflated with iodoform, or in some cases with heated calomel. In cases in which there is much pain the insufflation of orthoform will be attended with results most grateful to the patient. One insufflation will often relieve pain for as long as twenty-four hours. Both nitrate of silver and chromic acid are also useful applications. The best method of applying either of them is to fuse a little of the pure drug on to a probe, and, having cleansed the surface of the ulcer, to paint it on. Last, the patient may be given for use at home a gargle composed as follows:—

R Chlorate of potash, 10 grains.

Black wash,  $\frac{1}{2}$  ounce.

Water, to 1 ounce.

This is most useful for the relief of pain and for cleansing the throat. As regards the treatment of adhesions, the less the operative interference, the better for the patient. It is never wise to resort to operation unless there are very strong reasons for trying to relieve the obstruction, such as rapidly increasing deafness, constant and intense earache,

or great discomfort to the patient arising from the nasal stenosis. Should operation be considered absolutely necessary every conceivable device will have to be tried for maintaining a larger opening. From observation on a great number of cases it is most surprising how great an amount of contraction may exist and yet cause comparatively little discomfort. When the opening is so small as to cause symptoms, it is generally sufficient to pass dilating instruments regularly and in increasing sizes in order to render the patient quite comfortable, and this the patient can be easily taught to carry out for himself. C. A. Porter (Lancet, Jan. 26, 1901).

Results of treatment of thirty cases of syphilis by the injection of serum derived from patients who have already suffered from syphilis and have arrived at the tertiary stage. The serum was obtained by means of cantharidin plasters. Doses varied from 10 to 40 cubic

centimetres, and were injected every third or fourth day for one or two months. Cases of refractory syphilis showed themselves quickly benefited, and such benefit has, in most cases, appeared to be much more permanent than that afforded by even prolonged treatment by mercury and iodide of potassium.

Syphilitic sores yielded rapidly to the local application of the serum in the form of compresses.

The best serum is to be obtained from robust persons in the later stages of syphilis, and those patients who have been treated with the serum yield, in turn, better serum than those who have been treated in the ordinary way with mercury. No experiments have been tried in cases either of tertiary or congenital syphilis. E. Moore (Dermat. Zeit., Apr., 1901).

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## T

### TENDONS, BURSÆ, AND FASCIÆ, DISEASES OF.

**Tenosynovitis, or Thecitis.**—Inflammation of a tendon or tendon-sheath may either be *acute*, when it is the result of injury, or *chronic*, when it is due to tuberculous infection.

**ACUTE TENOSYNOVITIS.**—In this form traumatism may give rise to suppurative inflammation, owing to the invasion of pyogenic microbes, the result, in many cases, of insufficient attention to antiseptics when the wound is dressed, or to the presence near the injury of a suppurative process. It may also result from repeated, though slight, contusions, such as those to which the hand is exposed in many occupations. Injuries of this kind in the palm of the hand are well known under the term palmar abscess. (See below.) Acute tenosynovitis may also ap-

pear as a complication of syphilis, gonorrhœa, and rheumatism. It is termed whitlow, felon, or panaris (see below) when the tendon-sheath of a finger is the seat of the acute suppurative process.

*Palmar abscess* may be due, as stated, to repeated contusions, but also to extension of tenosynovitis of the fingers, especially when the abscess is located on the flexor side of the little finger and the thumb, owing to the connection of their synovial sheaths with the general sheath common to the tendons of the palm. The three other fingers, as is well known, possess separate sheaths. When suppurative inflammation is present in the palm, high fever may occur, and the pain is severe in proportion to the resistance of the overlying tissue. Here, again, the pus may burrow in various directions or insinuate itself between the metacarpals



to the dorsum, and passing beneath the annular ligament reach the tissues of the forearm and beyond. Death has been known to ensue in such cases from pyæmic infection. The palmar lesion may, in turn, become aggravated; necrosis of the carpus may occur and dangerous hæmorrhages suddenly appear through involvement of a large vessel in the suppurative process.

*Felon, or Whitlow.*—The term “felon” is often applied to a superficial inflammation of the finger or toes around the nail and sometimes causing loss of the latter. This variety has been treated under NAILS, DISEASES OF (volume iv). The form considered here is that to which “felon” more properly belongs: inflammation of the deeper tissues, including the tendon and its sheath of the distal phalanx. This is usually due to traumatism,—a blow or crush,—and develops soon after the receipt of the injury, though sometimes only toward the end of the second day. Severe pain, heat, throbbing, and more or less fever betoken the presence of quite an acute inflammatory process. The pain becomes extremely severe and almost unbearable if surgical measures are not resorted to. If the abscess be allowed to proceed without relief, extension toward the hand may follow or the pus gradually works its way toward the surface, forming a volcano-like mass, which, upon healing, leaves the thumb deformed—sufficiently in some cases to impair its usefulness.

**Treatment.**—The treatment depends, of course, upon the condition presented at the time the case is seen. In its incipient stage an acute tenosynovitis may sometimes be cured by rest, elevation of the part, and application of cold compresses or prolonged baths in a solution of borate of sodium, especially if small

doses of iodide of potassium are given internally—with copious draughts of water. In the vast majority of cases, however, such a favorable result is not reached, and the inflammatory process proceeds to suppuration. A free incision including the tendinous sheath, exposure of all sinuities that appear suspicious, and curetting, all performed under strict antiseptic precautions, represent the only safe procedures. Thoroughness at this time avoids not only a repetition of the operation, which otherwise often becomes necessary, and the likelihood of a deformity is greatly reduced. General anæsthesia is to be preferred.

In *palmar abscess* the danger of delay is especially great, as already shown. A free incision is imperatively demanded, the line followed being that of the metacarpal bone nearest the abscess. In doing this, however, the location of the palmar arch should be borne in mind, and the artery avoided. Should it accidentally be cut both ends should be carefully picked up and ligated. In some cases, the abscess appears to have “broken” spontaneously early in the history of the case, and a flow of pus seems to verify this conclusion. The pus originates in small superficial abscesses, which sometimes form in addition to the deeper and greater one, and rupture early through the pressure exerted from below. They tend to mislead the operator by causing him to delay the evacuation of the main abscess. The danger involved not only includes extension of the purulent process beyond the hand, but also destruction of the tendons of the latter, followed by permanent flexion of the finger: the “*main en griffe*.”

In *whitlow*, or *felon*, the general indications are similar, but the chances of arresting the inflammation early are greater if the case is seen early. This

may often be effected by keeping the finger wet with alcohol, diluted with an equal quantity of camphor-water. A thin bandage well soaked with the solution is wrapped around the finger and oiled silk is carefully wrapped around the whole to prevent evaporation. A strong solution of borax, or a bichloride solution 1 to 3000 may also be used in the same manner, but carbolic-acid solutions should not be employed, several cases of gangrene having been ascribed to their use. If after forty-eight hours no improvement is noted, a free incision, reaching the bone in the distal phalanx and down to the tendons in the two others, is needed, the sheath being laid open. When this is not resorted to early, the distal phalanx may be found necrosed; hence the deformity left in so many cases of whitlow. If necrosis is present, dead portions of the bone should be removed; but little apprehension need be felt, since it rarely extends beyond the epiphyseal line. In the two lower phalanges, however, necrosis is of more serious import; the dead bone must either be removed or the finger amputated, according to the amount of osseous tissue involved.

**Chronic Tenosynovitis.** — Although this term implies an inflammatory process, the disease it is intended to represent is, in reality, but a manifestation of tuberculosis in the sheath. A nodular, more or less spindle-shaped swelling following the long axis of a tendon is formed, which contains, besides liquid, small bodies resembling rice or melon-seeds; hence called "riziform" bodies. These are either buried in the sac-wall or float freely in its liquid, and are found to contain, upon microscopical examination, tubercle bacilli. The local disease may assume a fungous form, and not only destroy the tendon, but spread to

neighboring tendons and joints. Tuberculous tenosynovitis usually develops near the wrist, and much less frequently in the tendons of the fingers, knee, and ankle. It gives rise to but little suffering, and, as a rule, interferes but slightly, if at all, with the functions of the affected extremity until well advanced. Its progress is, as a rule, quite slow. It may, if the health of the patient is materially improved, disappear spontaneously, or become fungous after penetrating the superficial tissues, as does typical tubercular abscess. It may occur as the complication of a joint tuberculosis. The riziform bodies facilitate diagnosis by conveying to the finger exerting pressure upon the swelling a crepitation recalling the presence of gravel.

**TREATMENT.**—The tendency to relapse which characterizes this disorder renders it imperative to thoroughly eliminate the local trouble and to treat the general dyscrasia as well. When the sac is purely cystic—*i.e.*, devoid of fungoid vegetations—a small incision, followed by evacuation and the injection of a solution of iodoform in olive-oil or in ether, will often suffice. When riziform bodies are present, however, more effective means are necessary, since they represent as many foci for tubercle bacilli. The sheath should be laid open and its interior surface and the tendon thoroughly cleared with the curette. Fungoid vegetations still further complicate the case, and, unless every vestige be removed, including affected external tissues, sheath, and tendon, recurrence is sure to occur. Asepsis is of the greatest importance, general toxæmia occurring readily if proper precautions are not taken. The general treatment should include the administration of creasote and other measures indicated in pulmonary tuberculosis.



**Wounds and Injuries of Tendons.—**

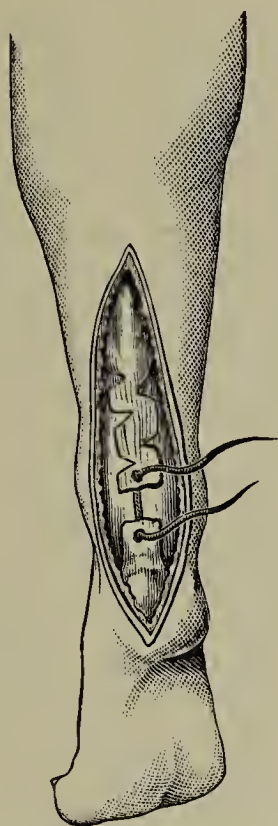
**DISPLACEMENT.**—A tendon is sometimes displaced from its normal position by a violent motion in which its normal axis of traction is more or less departed from, the sheath being torn. Often it immediately returns to its normal position, but sometimes it does not, and local pain, with impairment of motion, result. The peroneus brevis probably shows the greatest predilection in this direction, and comparatively often slips out of its groove, being felt over the malleolus when the foot is flexed and extended. Displacement is most frequently observed in connection with dislocations and fractures, and in the latter a tendon may insinuate itself between the fragments, and thus prevent approximation and union.

**Treatment.**—By gentle manipulation with flexion or extension of the extremity, as required to reduce the tension upon the tendon, the latter can usually be restored to its normal position. Once displaced, a tendon is liable to again leave its bed. A suitable retentive dressing and bandage should be so applied as to hold *in situ* until thorough repair of the torn sheath has occurred.

**RUPTURE.**—Under the influence of a sudden effort the contraction of a muscle may exceed the resistance of the fibres of its tendon, and the latter gives way. The tendon of the rectus femoris above and below the patella, the tendo Achillis, the tendon of the triceps near the olecranon, and that of the biceps near the forearm are those which are most exposed to this accident. The rupture is usually complete, and a cavity may readily be felt where before the tendon was continuous, the gap being increased by extension. When the knee is the seat of rupture, there is marked effusion in the joint, and the patella is drawn up-

ward: a deformity very readily noticed. There is a distinct snap when the rupture occurs, immediate loss of power in the limb, and sometimes severe pain.

**Treatment.**—Approximation of the ends by full extension of the limb, application of retention bandages and splints, and immobilization of the limb at once suggest themselves. If these can be carried out satisfactorily, perfect union occurs at the end of two months,



Elongation of the tendo Achillis. (Poncet.)

(Revue d'Orthopédie.)

and, with a little care for a few weeks subsequently, perfect cure ensues. This happy result is not always met with, however, and in the majority of instances the tendon-ends cannot be held together by simple means, especially when the muscle draws the proximal end away to such a degree that traction has to be exerted to bring its extremity down to the lower. In such a case, therefore, it is better to suture the ends. This is especially important when the traction is due

to the action of large muscles, such as those of the calf or thigh. Under careful antisepsis this can now be done without the least danger, even at the knee. The incision should, if possible, be made to one side of the tendon, and not over it, to reduce the chances of adhesion. Rupture of the tendo Achillis is sometimes managed with difficulty, or tends, if union is obtained, to cause pes equinovarus. Poncet avoids this by cutting the edges of the tendon zigzag fashion to elongate it, as shown in the cut, or by Czerny's method, described below.

**WOUNDS OF TENDONS.**—Tendons are susceptible to traumatism of any kind, but their density causes them to resist penetration. Puncture-wounds, therefore, are seldom met with, the point of the instrument being diverged in the majority of instances. The sheath, however, is usually torn, but it quickly recovers, if pyogenic organisms have not been introduced. Incised wounds are of little moment unless the entire tendon is cut, when, with a snap, it assumes the relations outlined under RUPTURE. In the latter, however, the solution of continuity being subcutaneous, pyogenic elements are not introduced; in rupture due to the thrust of a knife, sword, chisel, etc., the contrary is likely, and the surgeon should always assume that he is dealing with an infected wound. He will thus insure an early recovery in all cases.

**Treatment.**—Whatever be the cause of the laceration, the ends should be stitched with buried catgut sutures, care being taken that the ends be carefully placed in apposition, or, better still, overlapped. It is sometimes necessary, in order to recover the proximal end, to slit the sheath, or to free it some distance from its surroundings to do this. The suture holds best when passed through

transversely about one-third inch above each free end. In some cases, as in bullet wounds, much of the tendinous substance has been carried away, while the softer and more elastic sheath remains, at least to a greater extent. If the ends of this are united, so as to form a continuous canal, a new section of tendon will be formed if the vitality of the sheath was sufficient from the start.

Lengthening of the tendon may also be resorted to. Either Poncet's or Czerny's method may be resorted to. Poncet's is described above. Czerny's consists in cutting the tendon half-through some distance above the end, then longitudinally toward the latter until near it. The portion thus partly detached is then turned down toward the other free end of tendon and sutured to it. If too great an extent of tendon has been lost, an animal tendon may be transplanted and sutured to both free ends. This forms the basis of a new tendon, the animal tendon being usually absorbed.

**Bursitis.**—Bursæ, protective cushions developed in the cellular tissue, may be normally provided, or acquired, when certain parts, superficial or deep, are exposed to unusual friction or pressure. These may become inflamed through injury or overuse, constituting *acute bursitis*, or through continued irritation, constituting *chronic bursitis*. The bursæ often become involved in diathetic processes, rheumatism, gout, and syphilis especially.

**ACUTE BURSITIS.**—An acute inflammation of a bursa may be serous or purulent, and, as stated, is usually due to injury. When located superficially there is marked swelling, redness, and local heat. When an inflamed bursa is situated in the deeper tissues, the swelling can only be detected with difficulty, if



at all, and the pain, especially on motion, is severe. General febrile symptoms often appear when a deep bursa is involved, especially when there is a tendency to suppuration, this being likely to extend. The inflammatory process sometimes extends to a neighboring joint, including the synovial sac, which is easily penetrated. The diagnosis can usually be established by judging the effects of motion. Extreme abduction or adduction of the humerus, for instance, causes severe pain, if the inflamed bursa is under the deltoid; when the bursa between the quadriceps extensor and the femur, or that under the ligamentum patellæ, is the seat of the inflammatory process, flexion of the leg upon the thigh becomes painful, through the pressure thus exerted upon the bursa.

*Treatment.*—Absolute rest in bed and immobilization, by placing the extremity in a splint and pressure, elevation of the part, and cold or hot antiseptic applications are indicated. If the active symptoms persist notwithstanding these measures, the sac should be aspirated if the fluid is serous, followed by pressure or free opening, if pus be present, and the purulent discharge completely evacuated, and a saturated solution of iodoform in ether injected. Lugol's solution mixed with an equal quantity of glycerin is also useful.

**CHRONIC BURSTITIS.**—Chronic inflammation of a bursa is met with much more frequently than the acute form. It develops insidiously, is unattended by pain, and manifests itself only by marked swelling, which varies in density according to the thickness of the bursal wall. This becomes quite dense sometimes, and conveys to the touch a feeling of hardness suggesting bone. In some cases it may be thin and the cavity be greatly distended with fluid. The harder

bursa is usually separated into various cavities by thick, fibrous partitions, or the interior is studded with villous growths, which sometimes become detached and form riziform bodies. Occasionally it undergoes calcification.

Sixty cases of disease in the bursa under the ilio-psoas and in the bursa beneath the aponeurosis of the gluteus maximus over the great trochanter have been personally collected. The subiliac bursitis, of which there were fourteen examples, gives rise to a swelling below Poupart's ligament, which may extend downward as far as the middle of the thigh; the swelling is smooth, more or less sensitive, and usually fluctuating; there may be neuralgic pains, from pressure on the adjacent nerves, and venous thrombosis from pressure on the vessels. The movements at the hip-joint may be interfered with, and the limb may assume an abnormal attitude; *e.g.*, abduction, external rotation, and slight flexion, resembling that of hip-joint disease. It is to be differentiated from the latter by the absence of rigidity, of shortening, and of tenderness over the joint. The development of a bursal hygroma may occupy several years. The bursitis over the great trochanter resembles that under the ilio-psoas, and it is to be diagnosed from a periarticular abscess in hip disease and from disease in the trochanter itself. The bursa itself is not infrequently the seat of tuberculosis, and more often on the left side than on the right. Sülzer (*Centralb. f. Chir.*, No. 21, '99).

**HOUSE-MAID'S KNEE.**—This popular term is applied to chronic swelling of the prepatellar bursa, as a result of continued or repeated pressure while scrubbing, etc. It is located immediately at the knee, and the globular swelling projects anteriorly when the patient is sitting. It is usually quite large, the size of a small orange, and, its wall being comparatively thin, it generally fluctuates. At times it becomes irritated through continued pressure and may be-

come slightly painful, the limbs at the same time becoming somewhat stiff and weak at the knee.

*Treatment.*—Aspiration followed by injection and subsequent removal of a 1 to 1000 solution of corrosive sublimate or a solution of iodoform suffices in many simple cases. If the presence of pus is detected, a free incision is resorted to nowadays, and that without the least danger if asepsis is carefully adhered to. An opening into the sac may be made on each side, and a drainage-tube passed through to insure complete evacuation of the fluid. When there is ulceration the same incisions are of service, but lower down. Again, the sac may be completely extirpated through a lateral incision.

**BUNION.**—This consists of an enlargement of the bursa over the metatarsophalangeal articulation of the big toe, but which may also present itself over other joints of the foot. It is often due to the pressure of ill-fitting shoes, which not only exert pressure upon the bursa overlying the articulation, but also tend to force the big toe away from its normal line and the metatarsal extremity of the second phalanx outwardly. The bursa thus finds itself pinched between the bone and the overlying leather. Bunions may cause but little trouble, when not compressed, but, irritated in the manner outlined, they become inflamed and at times exceedingly painful; the skin becomes highly congested and tense; tumefaction occurs, accompanied by accumulation of fluid in the bursa; and locomotion becomes difficult. In some cases suppuration follows; the pus may then burrow through the bursal wall, give rise to cellulitis, and involve the metatarso-phalangeal joint.

*Treatment.*—The shape of the footwear is of primary importance in the

treatment of the cases. The inner side of the shoe should accommodate the bunion in such a manner as to avoid all pressure, while the great toe should have ample room to project in a straight line from the foot, and not be pushed toward its median line. Pointed shoes are pernicious in this connection. A change of foot-wear is sometimes sufficient to bring about recovery. The local treatment is that of bursitis. Iodine painted over the projection is advantageous. When the applications become irritating, a salve of equal parts of cosmolin and tannic acid, as advised by Gross, soon brings on resolution. Tapping or the evacuation of pus by incision, followed by curetting of the bone, sometimes become necessary. These are absolutely safe proceedings if conducted antiseptically.

The disinclination of the patient to take exercise causes a gouty or lithemic condition which increases the inflammation and deformity. The old operations commonly resulted in stiff joint and other discomforts. A very simple operation is all that is necessary in many cases. The operation consists in a longitudinal incision from one-half to three-fourths of an inch in length along the inner surface of the extensor tendons, the site of the hyperostosis is exposed, and a sharp chisel separates the button of the bone readily from the head of the metatarsal bone. The open bursa can then be trimmed out with a pair of scissors without difficulty, and when the wound is sutured and the skin pressed against the surface of the bone from which the button is removed, it becomes quickly adherent, and the bunion is at an end. The patient is allowed to walk in from ten days to twelve days. R. T. Morris (*Inter. Jour. of Surg.*, Nov., 1903).

**Ganglion.**—This name is given to a rounded tumor usually about the size of half of a hazel-nut, which generally forms on the back of the hand. It may be soft and yielding when pressed upon,



or exceedingly hard, suggesting the presence of an osteoma. It is not painful even under pressure, and gives rise to no inconvenience. When, however, as in the case of pianists, the fingers are moved rapidly and with power long periods at a time, a sensation of weight or stiffness is experienced and occasionally slight pain. According to Volkmann, a ganglion is a pouch-like projection of the synovial membrane of a joint in the majority of cases, and rarely arises from a tendon-sheath. It contains a thick, honey-like liquid, thus forming an independent cyst, or a synovial hernia.

**TREATMENT.**—Pressure or a sharp blow causes the sac to rupture, the liquid being promptly absorbed. This rather brutal—and therefore unsurgical—method is now generally supplanted by subcutaneous divisions with a small bistoury, under strict antiseptic precautions. The small incision being made, a piece of iodoform gauze is placed over the sac, and, pressure being exerted with the thumb, the fluid is quickly evacuated and dispersed. Large tendinous tumors sometimes require excision.

**Contraction of Tendons and Fascia.**—**DUPUYTREN'S CONTRACTURE.**—This is an obstinate form of contraction affecting principally the palmar fascia, prolongations of which, as is well known, run by the side of the fingers, and are attached to the periosteum of the first phalanx. By contracting, these prolongations gradually cause the fingers to close upon the palm of the hand and to remain in this position permanently. The ring-finger is usually that first involved, but in the majority of cases the three fingers on the ulnar side of the hand are contracted, the index finger and thumb rarely. Either hand may be affected, but occasionally both become so flexed as to paralyze their usefulness.

It usually begins as a small, hard mass near the metacarpo-phalangeal articulation; contraction of the corresponding finger begins and proceeds until the nails fairly dip into the tissues of the palm.

Dupuytren's contracture has been traced to many causes: the rheumatic and gouty diathesis and other general conditions; but in practically all cases there is a history of local injury of a persistent kind, such as the continuous forcible handling of a certain tool, the pressure of a cane-knob, etc. Again, it is occasionally observed after prolonged illness in which the general vitality of the organism has been severely taxed. It is rarely observed before middle age, and almost always in men. The patient is usually possessed of good general health.

*Treatment.*—The progress of the contraction is steady until the hand becomes totally crippled, and the only effective means at our disposal are surgical. Efforts at extension are unavailing, but, when this is tried, thick elevations are seen to form in the palmar cavity and to push its superficial tissues upward. It is upon these bands that efforts at liberation should be concentrated. A small tenotome should be introduced at various places under each, and the attachment of the bands to the overlying skin so freed as to permit of full extension of the fingers. A splint should then be applied and worn, not only until recovery of the wounds, but during several days subsequent thereto. Then daily passive motion and massage should begin, coupled with a mild galvanic current, until the motions of the fingers have been completely recovered.

In some cases it is necessary to obtain complete extension, to remove the hardened palmar fascia. An incision is made along the length of each band, and the

skin is carefully dissected up from the latter. This being done, the hard tissues constituting the band proper are separated from their surroundings, then cut out as completely as possible. These cases need close watching, since the danger of recurrence is always great, and passive motion, massage, etc., should be resumed as soon as there is the least evidence that the affection is returning.

Pendulum apparatus for contracted fingers and hand consists of an arrangement that can be attached to the side of a table, applicable to increasing the motion of stiff finger-joints. Patients who resist any attempt at passive motion in the ordinary way, after a short time under the correction of the pendulum apparatus obtain considerable motion. Nebel (*Zeit. f. orth. Chir.*, p. 17, B. 5, H. 1, '97).

**TRIGGER-FINGER.**—According to Féré, two groups of this disorder may be recognized: the organic and the functional. The causes for the organic variety may be found in the tendons, fascia, muscles, or in conditions which will tend to modify the directions of muscular action, and the movements of flexion and extension. The functional class may be reflex, following local irritation, or may be a local manifestation of certain neuropathies. Cases of this class may arise independently of any voluntary movements.

The disease consists of a peculiar and sudden locking of the finger when it is flexed or extended to a certain point. It remains in the position acquired notwithstanding ordinary efforts to bring it to another position. A powerful voluntary effort sometimes succeeds, however; but in some cases, the assistance of another person is necessary. The disorder is usually limited to one finger, the middle finger being that most frequently affected. The majority of cases are observed in females. The chances of re-

covery under appropriate treatment are good.

*Treatment.*—The treatment of trigger-finger, as outlined by Riesman, consists in the application of iodine, electricity, massage, passive motion, and fixation of the finger by means of a splint. In inveterate cases have been treated by operation, which usually consists in removing whatever obstacle to free movement exists. If an underlying cause, like rheumatism or gout, is ascertainable, proper general methods are to be instituted. In cases accompanied by pronounced paræsthesial phenomena, the use of ergot may be tried.

**TENDON-TRANSPLANTATION.**—In the treatment of paralysis, especially spinal paralysis in children, transplantation of tendons is an effective procedure. E. Kumik (*Münchener med. Wochen.*, Feb. 12, 1901) describes four operative methods: The first he considers inadvisable, since it necessitates the sacrifice of a functionally-healthy muscle. It consists in choosing a healthy muscle which can be spared, dividing its tendon, and suturing the central portion to the tendon of the paralyzed muscle. The second operation, Vulpinus's, consists in dividing the whole or a part of the tendon of the paralyzed muscle, and suturing the peripheral end to the tendon of a functionally-active muscle. The third variation consists of splitting the tendon of a functionally-healthy muscle into two parts, and attaching one part to the tendon of the paralyzed muscle. The fourth proceeding, of which he has only availed himself once, and which is said to give very accurate and good results, is the suturing of a split-off portion of a healthy muscle-tendon to a properly-chosen site in the periosteum.

The success of the operation depends



partly on the correction of the displacement, and this is better carried out by a lengthening or shortening of tendons than by simple tenotomy. Kumik uses Beyer's (really Poncet's, see page 139) operation for the former, which consists in cutting into the tendon in step shape, or, in dealing with broad tendons, he makes two longitudinal incisions of equal length, one 1 centimetre higher than the other. From the lower end of the second, and from the upper end of the first, transverse incisions are made in opposite directions. Thus, the tendon is lengthened by the sum of the two incision lengths. The shortening operations are either excision of a part of the tendon and end-to-end suture, or simple division and suturing the ends overlapping one another. Tendon-surgery has been greatly advanced by a skilled combination of tendon-transplantation with tendon-lengthening or shortening.

The operations can be performed for the functional improvement of cases of paralytic talipes equino-varus, spastic talipes equino-valgus, congenital talipes equino-varus, radial paralysis, and quadriceps extensor cruris paralysis.

The results are very satisfactory, and from the patients' and patients' parents' view especially, because splints and expensive cumbrous apparatus were no longer required.

The surgeon ought to propose the operation, when the paralysis is no longer active, and when no functional improvement has shown itself during the course of a reasonable time: for example, one to two years. Operative interference is, however, always indicated if the resulting deformity is increasing. But an exact diagnosis is necessary before undertaking an operation; it is absolutely essential to be fully informed

as to the electrical and other conditions of each individual muscle of the limb. After the operation is performed, a splint of plaster of Paris, kept in place by means of strips of gum-elastic strapping, is applied. From six to eight weeks' massage, active and passive movements, are resorted to.

### TENSION OF THE EYEBALL, DISORDERS OF.

To preserve the shape and proper relations of the refracting surfaces of the eyeball, the sclero-corneal coat is kept distended by its contents, which normally press outward with a force equal to the weight of a column of mercury 25 or 30 millimetres in height. To nourish the tissues contained within the outer coat of the eyeball there is a continuous secretion of nutritive fluid; and this fluid, just as constantly, must escape from the eyeball to avoid overdistending it. In pathological conditions the tension of the eyeball may be increased or diminished. Increased tension is indicated by + T 1, + T 2, or + T 3, which indicate different degrees of hardness; and diminished tension is indicated by — T 1, — T 2, or — T 3, the higher number indicating the greater departure from the normal.

#### **Glaucoma.**

*Increased tension* is generally called *glaucoma*, from the Greek, *γλαυκός*, sea-green. The term was applied on account of the greenish hue of the pupil in elderly people, when dilated, as it commonly is, in glaucoma. But the increased intra-ocular tension is now recognized as the essential characteristic of the disease.

**Symptoms.**—The eyeball is found more resistant to pressure than normal. This is tested by pressing on it above or below the cornea through the partly closed lids. The tips of the two forefingers are com-

monly used. In the early stages the increased resistance may not be noticeable or it may only be present a part of the time.

A very early symptom is the appearance of colored rings around distant lights at night. The colors are arranged as in the solar spectrum, with the violet toward the light. These halos may be absent in glaucoma, or present when the tension is not increased. Proximity of the iris to the cornea, shallowness of the anterior chamber, frequently precedes any outbreak of other symptoms; and in the later stages the anterior chamber may be obliterated, the iris coming in contact with the cornea. Dilatation of the pupil usually attends glaucoma. In the early stages the pupil still responds to light and convergence, and varies in size from time to time with the variations of tension. Later it becomes widely dilated and fixed. When the tension of the eyeball is much increased, or has increased rapidly, the cornea is found comparatively insensitive to touch.

Pain occurs, and is severe in most cases. It may be limited to paroxysms, or may be constantly present. It is often referred chiefly to the brow or cheek, or the temple or side of the nose. It may be mistaken for neuralgia or the pain of inflammation. In glaucoma that has lasted some time, the large tortuous veins that emerge from the sclera some distance back from the corneal margin are dilated and prominent. During the paroxysms there is generally a marked pericorneal redness. When the tension is very high, or has risen rapidly, the cornea will be found hazy,—“steamy,”—and may hide the deeper parts of the eye.

When the media are clear the ophthalmoscopic appearances are characteristic. In cases not too recent the optic disk is cupped or excavated deeply, the

excavation extending to the extreme margin of the disk, and having abrupt or overhanging sides over which the retinal vessels appear sharply bent. The retinal veins are often dilated and the arteries rather small. The arteries may be seen to pulsate, especially where they pass over the margins of the cup; and the normal pulsation of the veins may be increased. The optic disk is often surrounded by a ring of choroidal atrophy having an edge that shades rather gradually into the normal choroid, called a halo-atrophy.

**Diagnosis.**—Glaucoma may be distinguished from CATARACT by pain, dilatation of the pupil, narrowing of the field of vision, cupping of the optic disk, and absence of opacity of the media except during inflammatory exacerbations. From NEURALGIA it must be distinguished by the fundus-changes, and the impairment of visual acuteness or the field of vision, that are present in simple glaucoma, which is most liable to be confounded with that disease. From IRITIS glaucoma is distinguished by the shallow anterior chamber, the dilated pupil, the impairment of the field of vision, the absence of so-called punctate keratitis, and the marked exacerbations and remissions. From KERATITIS glaucoma may be known by the symptoms just enumerated, and the smoothness of the corneal surface. The discrimination between different varieties has been indicated in describing them.

**Etiology.**—Glaucoma may possibly be caused by excessive secretion of fluid within the eyeball; or by alterations in such fluid which hinder its escape. But the causes that most commonly produce it, and are best understood, act by causing obstruction of the channels of outflow.

The chief channels for the escape of fluid from the eye pass from the periph-



ery or "angle" of the anterior chamber through "Fontana's space" to a circle of lymphatic and venous channels in the adjoining sclera, called the canal of Schlemm. Adhesion of the periphery of the iris to the cornea or pressure of the iris against the cornea closes these channels.

The liability to glaucoma increases with age; and Priestley Smith has pointed out that the crystalline lens, like other epithelial structures, continues to grow until old age, diminishing the space between it and the ciliary processes, and increasing the liability of these processes to be pressed against the iris and close the outflow channels.

The use of a mydriatic is liable to cause glaucoma through thickening of the iris at its periphery during dilatation of the pupil. Exclusion of the pupil by iritic adhesions is likely to lead to pushing forward of the iris by fluid from the deeper parts of the eye, and blocking of the outflow channels. Dislocation or swelling of the crystalline lens is likely to do the same thing. Causes of swelling of the ciliary processes and iris, as overweariness, and physical or mental shock may cause outbreaks of glaucoma; and constitutional conditions, particularly gout, have been accused of causing it. Pain, insensitiveness of the cornea, and cupping of the optic disk are due to the excessive intra-ocular pressure.

**Varieties.** — Glaucoma in its typical form is marked with exacerbations, during which the tension of the eyeball is increased, with pericorneal redness, increased pain, diminished acuteness of vision, and generally increased severity of all the symptoms. This has been called *inflammatory glaucoma*. It is either *acute* or *chronic*. Sometimes the exacerbation is so severe as to destroy light-perception

in a few days, or even a few hours: *glaucoma fulminans*. When the increase of tension is preceded or accompanied by retinal hæmorrhages it is called *hæmorrhagic glaucoma*. Glaucoma quickly returning after iridectomy and compelling the removal of the eye is *malignant*.

When no noticeable exacerbations occur, but the increase of tension and impairment of vision are gradually progressive, the condition is called one of *simple glaucoma*. When glaucoma arises in an eye not previously diseased it is called *primary*. When it follows other ocular disease or injury, as wounds causing swelling of the crystalline lens, inflammation of the iris, or intra-ocular tumor, it is called *secondary glaucoma*. When all sight has been lost, and the tension is continuously elevated, the case is said to be one of *absolute glaucoma*.

**Prognosis.**—Glaucoma not efficiently treated ultimately causes complete and hopeless blindness, usually with a period of great pain. This end may be reached in a few days or only after many years. Treatment may save what sight remains, or some that has been very recently lost may be restored. But vision that has been lost more than a few days or weeks cannot be regained. The prognosis for hæmorrhagic glaucoma is extremely bad. Simple glaucoma often pursues its course unchecked by any treatment. Inflammatory glaucoma is quite amenable to the usual remedial measures if applied early. Secondary glaucoma can be cured by removal of its cause, as by the extraction of a swelled or dislocated crystalline lens. The prognosis must always be guarded, for cases mild in the beginning may become fulminating or malignant.

**Treatment.** — Iridectomy is the chief remedy for glaucoma. It is best done by making with a narrow knife an incision

a little back from the corneal margin close to the periphery of the iris. One-fifth of the iris should be removed, quite up to its ciliary attachment. The after-treatment resembles that of cataract extraction, except that the patient may be allowed more freedom.

*Sclerotomy* may be anterior or posterior. The former consists in making a scleral incision parallel to the corneal margin much as for iridectomy, but longer and not completed, a bridge of sclera being left standing at the middle of it. Posterior sclerotomy consists in making an incision in the direction of an antero-posterior meridian of the eyeball, usually below the tendon of the external rectus, allowing a little of the vitreous to escape.

The common causes of glaucoma must be avoided, particularly the use of a mydriatic, unless iritic adhesions (posterior synechiæ) are present. If operation is not permitted, myotics—as physostigmine (eserine) and pilocarpine—may be instilled, combined with cocaine. Taking blood from the temple and bathing the eye with water as hot as can be borne tend to diminish pain.

Successful operation, and belief that visual acuity is improved in some cases. He states that by using a blunt dissector it is not usually necessary to ligate the external jugular vein or to cut the spinal accessory nerve, and the operation is neither lengthy nor exceptionally difficult. G. F. Suker (*Ophthalmic Record*, Aug. 16, '99).

Resection of the cervical sympathetic, performed seven times by Jonnesco in 1898, has recently been resorted to with success by several clinicians. Its various steps are as follow: An incision four inches in length is made on the right side downward from the mastoid process along the posterior border of the sternomastoid muscle. The external jugular vein is cut and tied. The sterno-mastoid

is then separated from the trapezius and the spinal accessory nerve cut. A deep dissection must then be made, exposing the carotid sheath. This is opened in order to locate the pneumogastric nerve. The carotid, internal jugular, and pneumogastric nerve are then pulled forward, exposing the rectus capitis anticus major muscle, on which the superior cervical ganglion rests. Tearing through the fascia, the ganglion is located and stripped, then cut high up with curved scissors and all its branches severed, about one inch of the trunk of the sympathetic below the ganglion being removed.

There is, as a rule, no change in the pulse or respiration. The wound is closed with interrupted sutures, and the neck placed in a plaster cast, or some such reliable apparatus to avoid twisting of the neck. The time required for operation averages from fifteen to thirty minutes.

The results reported are: immediate cessation of pain, fall or tension, reduction in the size of the pupil, and improvement of sight when the optic nerve was not already totally destroyed. Jonnesco makes a premastoidal incision. Abadie performed it successfully in a man who had already lost one eye by enucleation for glaucoma, and whose sufferings led him to beg the author for enucleation of the second eye. Instead, Abadie removed the superior cervical ganglion of the sympathetic of the same side and obtained cessation of all the symptoms slowly and progressively, even to clearing up of the media.

Successful operation in a case which presented a typical picture of unilateral chronic glaucoma; tension, + 3; vision reduced to light-perception in the affected eye, with the usual fundus changes and much pain. Ball (*Med. Review*, Aug. 26, '99).

Removal of the right upper cervical sympathetic ganglion is of no service in glaucoma simplex where vision has been reduced to zero, but may be of service in arresting the disease in the earlier stages and retain vision before atrophic changes have taken place in the nerve, retina, and choroid.



After myotics and iridectomies have failed to relieve the disease, it is then when one is justified to advise sympatheticectomy in hope of relief from permanent blindness. Even then there is no assurance that the glaucomatous attacks will not return months afterward and destroy what has been gained.

The operation in skillful hands is not a dangerous one, nor has there been any deleterious effects upon the patient, except the numbness of the lobe of the right ear and along the inferior maxillary. D. H. Coover (Phila. Med. Jour., March 16, 1901).

Sympatheticectomy is indicated in glaucoma simplex, inflammatory glaucoma where iridectomy has failed, hæmorrhagic glaucoma early in the disease; and it should be tried in absolute glaucoma with pain, in preference to enucleation. In unilateral trouble the ganglion of the corresponding side should be excised. While sympatheticectomy may not be curative in every case of glaucoma, the results thus far have been sufficiently satisfactory to make it a desirable procedure in this much-dreaded disease. H. J. Williams (Medical News, Apr. 6, 1901).

Resection of the cervical sympathetic. Review of the cases in which operation has been done for the relief of glaucoma, 86 cases in all. Only about 13, however, had been followed sufficiently long to form any basis for deductions. None of these were made worse; 1 was unchanged, and the remainder were improved, 5 of the latter subsequently suffering relapses. The operation is a safe procedure in the hands of a skillful surgeon and apparently never does any harm. The results have been so varied that one cannot yet be sure in what cases it can be advantageously employed. It does not replace iridectomy, but may possibly supplement the latter in case this is refused or has already resulted disastrously to the other eye, or is contra-indicated. W. B. Marple (Medical Record, May 10, 1902).

INCREASED OCULAR TENSION IN CHILDHOOD leads to distension of the eyeball: *buphthalmos* or *hydrophthalmos*. The eye

becomes visibly distended, especially the cornea. The pupil remains small, the eye is commonly myopic; vision deteriorates, and is likely to be entirely lost. In some cases iridectomy has seemed to check the course of the disease.

**Diminished tension of the eyeball** follows all perforating wounds, and continues with corneal fistula or cystoid cicatrix. It may also be caused by injuries that cause no wound of the ocular tunics, apparently by nerve-influences. Softening of the eyeball commonly attends chronic cyclitis or iridocyclitis, in which connection it indicates serious intra-ocular changes.

Temporary softening of the eye attended by pain, photophobia, and deep hyperæmia of the eyeball is called *ophthalmomalacia*. The attacks may last hours or days, and are liable to recur. Rest of the eyes, hot applications, and weak solutions of eserine are indicated.

EDWARD JACKSON,

Denver.

## TETANUS.

**Definition.**—An acute or subacute infectious disease caused by a specific organism, the tetanus bacillus, and characterized by violent tonic spasms with marked exacerbations and remissions. Tetanus is also called TRISMUS and LOCK-JAW, and, when occurring in infants, TRISMUS NASCENTIUM or TETANUS NEONATORUM.

**Varieties.**—The infection usually takes place through an open, though often inconspicuous, wound: *traumatic tetanus*. When it occurs spontaneously or after exposure to cold, no wound being discoverable, it is called *idiopathic tetanus*.

**Symptoms.**—Following some injury, slight or severe, and usually ten days

after—although longer periods of incubation have been noted—the first symptoms of tetanus appear. There are slight stiffness of the neck, and some rigidity of the muscles of mastication with interference with the movements of the tongue. In a small proportion of cases chilly feelings may be complained of, and the wound, if unhealed, is apt to become tender and painful.

Yawning has often been noticed to be a forerunning symptom of tetanus. Henry Gray Croly (Brit. Med. Jour., Jan. 8, '98).

There is often some muscular twitching in the vicinity of the wound, and, as the disease gradually develops, the muscles of the jaw begin to exhibit marked tonic spasms, resulting in the typical "locked jaw." The facial muscles are also often attacked, producing distortions of facial expression. The head is often drawn backward and the dorsal muscles become involved, causing backward bending of the vertebral column. As the spasm extends to other trunk-muscles, the body may be bent forward, backward, or to one or other side according to the relative severity of the contractions in different muscle groups. The muscles of the hands, arms, and legs are comparatively little affected. In addition to the tonic muscular spasm, the least source of irritation, such as a light touch of hands or bedclothes, moving the limbs, a breath of air, a loud sudden noise, will cause, so soon as the attack is well established, a severe clonic exacerbation of spasm. The muscles of the whole body are thrown into violent contraction, with distortion, and often with great interference with respiration and phonation, or with spasm of the glottis causing partial asphyxia. This clonic exacerbation subsides after a few min-

utes or sooner, to be repeated under the slightest provocation. In the intervals some tonic spasm of the muscles persists. During the paroxysms there is usually profuse sweating; the pulse-rate runs up to 130 to 150; and in some cases there is hyperpyrexia,  $110^{\circ}$  to  $115^{\circ}$  F. being seen in fatal cases just before death. There may be retention of urine from spasm, and in any case the secretion is apt to be scanty. At first the tonic spasm causes comparatively little pain, but, after the attack reaches its height, the pain during the paroxysms is most excruciatingly intense. The mental faculties remain unimpaired throughout the attack. Death may occur from asphyxia or cardiac dilatation during a paroxysm, or at later stages of the disease from exhaustion. The attack endures from a few days to several weeks.

**Diagnosis.**—In typical cases following injury no difficulty in diagnosis could arise. The muscular spasms in STRYCHNINE POISONING simulate those of tetanus to some extent, but in strychnine poisoning the muscles of the jaw are not first, if at all, affected; in the intervals between the paroxysms there is no stiffness nor tonic spasm; the symptoms develop rapidly, not gradually, as in tetanus; and the history of the case is different.

The HEAD TETANUS of Rose, with its well-pronounced trismus, dysphagia, and facial paralysis, might be mistaken for rabies or hydrophobia, but in hydrophobia the trismus and involvement of neck- and back- muscles is wanting.

The most constant and striking feature of cephalic tetanus is the facial paralysis. It mostly affects all the branches of the facial nerve, sometimes the lower part of the face has alone been involved. This facial paralysis practically always occurs on the same side as the injury, but it has been seen on the opposite side. The



spasm on swallowing is less constant, and therefore less characteristic, than the paralysis of the seventh. Paralysis of some of the other ocular nerves has been noted in some few cases. E. F. Trevelyan (*Brit. Med. Jour.*, Feb. 8, '96).

In TETANY the nature of the spasm is different, and it especially involves the hands and feet.

In HYSTERIA some symptoms of tetanus may be simulated, but the presence of other hysterical phenomena and the history of the case should preclude error. A bacteriological diagnosis is also possible, and should, whenever possible, be made by means of cultures and stained preparations from pus of the wound and from the earth of the locality where the wound was received. A mouse inoculated with pus from a tetanus-infected wound will die within a few days: a fact which may be made use of in diagnosis.

**Etiology.**—The disease was at one time especially common in infants in the West Indies, and in all countries newborn children are particularly susceptible. After the first month of life, however, infants seem less liable to the disease than adults, the period of greatest danger being from 30 to 45 years. In general, males are more frequently affected than are females, and the negro races are more susceptible than are the white. Horses, cattle, sheep, and other animals are also frequently attacked. All forms of the disease are much more common in hot countries than in temperate climates. The disease is often especially frequent in certain localities (endemic tetanus), the soil seeming in such places to be peculiarly rich in tetanic bacilli. In almost all cases of tetanus there is traceable trauma, and many even doubt the possibility of the occurrence of the disease without a solution of continuity of tissue sufficient to permit the entrance of the pathogenic organism.

Idiopathic cases following exposure to cold do, however, occur. The most favorable forms of wounds for the development of tetanus are lacerated and contused wounds, especially where nerves are involved. Injuries in hands or feet are more apt to permit infection than are wounds in other parts. The disease, however, may follow surgical operations, extraction of teeth, vaccination, burns, frost-bite, insignificant scratches or puncture injuries from splinters, needles, tacks, etc. It may follow childbirth in women, although of late years this puerperal form of tetanus has been much less common than it was before the days of asepsis. In all wounds however received the probable source of contamination is the soil. A clean wound, of course, involves much less danger than a dirty one.

**Bacteriology.**—The tetanic bacillus growing under favorable conditions is a characteristically drum-stick-shaped organism, whose peculiar feature is a considerable enlargement at one end, in which enlargement a bright, round spore can be seen. The non-spore-bearing bacilli are long, slender, having rounded ends, are motile, and are numerous when conditions of temperature and other requisites to perfect development are unfavorable. The organism will not grow in the presence of the smallest amount of oxygen, which fact renders its successful cultivation a matter of some difficulty. It stains readily by Gram's method, and with ordinary watery solutions of the aniline colors. It is widely distributed in Nature, but especially common in certain soils in thickly-inhabited countries; in particular, soils which have been manured. It is also present in the atmosphere, especially a dust-laden atmosphere, and has been shown in the scrapings of the walls and floors of hos-

pitals in which tetanic cases have been treated. It is always found in the pus or other discharge from tetanus-infected wounds, and is frequent in the intestinal discharges of men and animals affected with the disease.

The organism possesses exceptional powers of resistance, retaining its virulence for months in dried pus, and surviving many antiseptic solutions and exposure to heat, etc., which would prove quickly fatal to other pathogenic germs. The specific powers which cause the symptoms of tetanus are generated by the bacteria in their processes of growth and nutrition, and have been isolated by Brieger from filtrates of several-weeks-old cultures in the shape of two basic substances: tetanin and tetanotoxin; and Brieger and Fraenkel have also isolated from these culture-products an intensely poisonous toxalbumin.

The tetanus bacillus remains localized in the part of the body to which it has been introduced, and does not invade other parts. In its development, however, certain extremely poisonous substances are produced, known as the tetanic toxin. This toxin is absorbed into the blood, and thus reaches all parts of the body. It seems to have been shown experimentally that the tetanic toxin possesses a special affinity for the cells of the cerebro-spinal axis, where it is deposited from the blood and becomes fixed. Editorial (Univ. Med. Mag., Feb., '99).

Literature apparently affords only three instances of the demonstration or the presence of tetanus bacilli in the blood of human subjects. A case is reported occurring in a man of 18, who developed tetanus eight days after an injury. Five days before death a blood culture was taken and bacilli were found in the culture. These had the characteristics of tetanus bacilli. There were also, however, cocci present. Injecting these cultures into rabbits produced the results usual after injecting

tetanus bacilli. There apparently was, then, a mixed infection; but the writer believes that the organisms were true tetanus bacilli, and that they were present in the general circulation. He thinks, therefore, that one must reckon with the possibility that tetanus bacilli may invade the organism in certain circumstances. Probably mixed infection plays a certain rôle in such conditions. O. Hohlbeck (Deutsch med. Wochen., Mar. 5, 1903).

The phenomena of tetanus are readily produceable in lower animals by the action of minute portions of these toxins introduced into the tissues.

The result of observers with regard to the passage of the toxin to the nervous system, directly along the nerves, has been personally confirmed. It was found that a certain dose of the toxin injected into the substance of an exposed nerve, the puncture afterward being closed, could produce tetanus, while no result followed the injection of the same quantity into the muscles after a portion of the nerve in connection with the part had been removed. Marie (Ann. de l'Inst. Pasteur, July, '97).

There exists a peculiar affinity between the tetanic toxin and certain cellular complexes of the central nervous system, and this affinity is manifested not only in the case of the central nervous system of the living organism, but also in that of the dead spinal medulla and brain; that is to say, isolated from the organism. When an injection is used of an emulsion of these organs,—that is, when the cerebral substance circulates with the blood,—the tetanic toxin, finding the nervous substance in circulation, is combined with it before proceeding to exercise its action on the cellular elements of the central nervous system, which is thus spared. Wassermann and Takaki (Presse Méd., Jan. 22, '98).

**Pathology.**—The disease is characteristically and purely toxic in nature, and without typical or constant morbid anatomical changes. There is apt to be a small, slightly-suppurating wound, with some congestion of adjacent parts. The



nerves in the vicinity of the wound have been noted as inflamed, red, and swelled, but characteristic lesions in the nerves or nerve-centres are wanting, although in the brain and spinal cord minute hæmorrhages, distension of capillaries, perivascular exudation, and pigmentary or other degenerative changes in nerve-cells have been described.

Hypostatic congestion of the lungs is a frequent post-mortem finding, and rupture of muscle-fibres as a result of violent contraction has been seen.

Forensic examination of blood and some fragments of tissue from a patient who had died of traumatic tetanus some five weeks before and whose body had been exhumed for confirmation of the diagnosis. Knowing the unstable nature of tetanus toxin, it was deemed impossible to discover its presence in the blood and tissues, but an attempt was made to do so by filtering the blood through a porcelain filter and injecting the clear, red fluid thus obtained into white mice. These little animals received quantities varying from  $\frac{1}{4}$  to 1 cubic centimetre of the fluid. Some died immediately after the injection, supposedly from the presence of putrid substances, to which they were more susceptible than others which lived for four days and then manifested symptoms of tetanus, from which most of them died, but from which one recovered. It is evidently possible to demonstrate the presence of tetanus toxin in the blood after the lapse of a number of weeks and after the dead body has putrefied. Symanski (*Centralb. f. Bakt., Parasit., u. Infekt.*, Dec. 31, 1901).

**Prognosis.**—The prognosis is grave, about 80 per cent. of traumatic and 50 per cent. of idiopathic cases proving fatal.

The two main elements in the prognosis of tetanus are the length of incubation and the temperature. The shorter the incubation, the more serious the case; if it be only two, three, or four days' long, the case will be almost certainly fatal. Any rise of temperature is ominous, and, the higher it is, the less

likely is the case to recover. Rapidity of pulse and respiration is also a bad sign. Courmont and Doyon (*Practitioner*, June, '99).

Puerperal tetanus is rarely recovered from, and the tetanus neonatorum of infants is almost always fatal.

(See also ECLAMPSIA, PUERPERAL, volume ii.)

The least dangerous cases are those in which the spasm remains localized in the jaw- and neck- muscles.

The afebrile cases offer a more hopeful outlook than do those in which the temperature is elevated. The number and violence of the paroxysms bear a direct relationship to the severity of the disease. When these paroxysms are frequent, severe, and involve all muscles of the trunk, recovery is scarcely hoped for.

**Treatment.**—The most important therapeutic question at the present time is as to the value of the tetanus antitoxin. It has been observed that animals which are very slightly susceptible to tetanus, such as the dog, may be rendered immune by the injection into their tissues of the tetanus-virus, in doses of gradually increasing strength; and that the serum of animals so treated has the power of conferring immunity upon other more susceptible animals, or of at least increasing their power of resistance to the tetanic toxins. The serum of immunized animals may be preserved for use by the addition of a small proportion of carbolic acid. The tetanic antitoxin of Tizzoni and Cantani is obtained from the serum of immunized dogs by treatment with alcohol. Experiments upon the lower animals with the tetanus antitoxin show that animals inoculated with fatal doses of tetanic virus often recover when treated with antitoxin.

The results thus far obtained by the antitoxin treatment in man, however,

have not been especially favorable, probably on account of the fact that the existence of tetanus is unsuspected until the amount of the poison is sufficient to cause spasm and too late to give good results from any specific treatment. Some favorable effect is, however, often noted, and the antitoxin or immunized serum should always be used, as it is probably the best single remedy now at hand. It is manufactured on a large scale in somewhat the same manner as is diphtherial antitoxin, and can be procured of almost all prescription druggists.

In giving intracerebral injections the following method is recommended: The anterior half of the scalp is first shaved and cleansed, then the point at which the injection is to be given is determined with the aid of a craniometer. In order to inject the fluid into the lateral ventricles, so as to avoid the motor centres, a point,  $2\frac{1}{2}$  to 3 centimetres from the bregma has been found to meet all indications. After cocainizing the scalp in this region a hole is drilled through the scalp and cranium; upon withdrawal of the bone-drill, the hypodermic syringe is inserted and the medicated fluid injected into the lateral ventricles. Albert Kocher (*Centralb. f. Chir.*, No. 22, '99).

From an examination of recent literature a list has been compiled of 25 patients treated by the intracerebral injection of antitoxin, with 11 recoveries and 14 deaths. Intracerebral injection does not interfere with treatment by hypodermic or intravenous injection of antitoxin, and the causative wound must be dealt with by thorough scraping and disinfection, or by amputation. Albert Carless (*Practitioner*, July, '99).

The following case should inspire greater confidence and hope in the curative effects of the injection of antitoxin into the dura mater. The wife of a cabinet-maker, aged 29, on June 2d, fell down the cellar-stairs, and, being in the third month of pregnancy, aborted the next day. On June 13th signs of tetanus appeared. The symptoms were unusually

severe, and the prognosis most unfavorable. Altogether the woman received 9 grammes of antitoxin,—4 of Behring's serum and 5 of Tizzoni's,—nearly twice the supposed curative dose, and half of it in the dural sac. On the seventeenth day of the disease she was in good spirits, and in a satisfactory condition, though the trismus had not entirely disappeared, with a pulse of 108 to 120. V. Leyden (*Berl. klin. Woch.*, No. 29, '99).

Cases of tetanus in which the symptoms develop soon after the receipt of the injury in almost every instance end fatally, while those in which the antitoxin or the use of chloral or other remedies proves beneficial belong to the type which develops later. In most of the cases that have occurred after the use of antitoxin, other remedies, particularly chloral, had also been employed, while in some parts of the country, where the disease had been quite prevalent and of a comparatively mild type, a large number of recoveries have been reported under the use of chloral alone. John Rogers, Jr. (*Annals of Surg.*, Mar., 1900).

Experiments on rabbits, guinea-pigs, and mice with tetanus antitoxin have shown that it is capable of successfully combating the disease, whether administered before or after infection. Relatively small doses administered before or simultaneously with infection with the toxin can prevent death. Severe cases can be cured if the antitoxin is administered early and in large doses. Subcutaneous injection is the least active, and only very large doses take effect administered in this way. More active are subdural injections; but the cerebral injections are most efficacious of all. This rule holds whether the injections are preventive or curative; the cerebral injections appear to be four times as active as the subdural. Von Török (*Zeits. f. Heilk.*, B. xxi; *Abtheilungen f. Chir.*, H. 1, 1901).

In acute tetanus the chances are against recovery; hence, in all severe wounds in regions where tetanus is not uncommon one must consider the preventive inoculations of antitoxin. Bazy, in France, after having four fatal cases



of tetanus in one year, has made it a practice to inject 10 cubic centimetres of serum into all patients who have come under his care with wounds which caused him to fear tetanus. He did not see a case of tetanus again, although his practice has been in a region notorious for tetanus. He has since reported that in one man in whom the inoculations were accidentally omitted tetanus did develop. The results of Nocard's method of preventive inoculations in veterinary practice are most striking. Among 63 veterinarians there have been inoculated 2727 animals with preventive doses of antitoxin, and not a single case of tetanus developed, while during the same period in the same neighborhoods 259 cases of tetanus developed in non-inoculated animals.

Many cases of human tetanus could doubtless be avoided if these preventive doses of 10 cubic centimetres of antitoxic serum were more generally used. Behring recommends very strongly that the antitoxin should be given not later than thirty hours after the first symptom and that 100 units be given at once. His 100 units mean 10 cubic centimetres of his serum. He has a certain standard toxin which he uses, and which remains constant. One unit is the amount of serum necessary to protect without symptoms 4,500,000 grammes of living mouse against this standard toxin. The French method of Roux is to calculate how many grammes of test-animal will be protected against a four-to five-day fatal dose of toxin. It is then stated to be one to so many millions.

In using the serum in man intravenous injections will act much more surely and quickly, and should be given when possible; 20 to 50 cubic centimetres should be given as the first dose, followed twelve hours later by 20 cubic centimetres more. Ten to 20 cubic centimetres should be given every twelve to twenty-four hours later till the spasms cease. In children half the dose should be given. The local and physiological remedies should never be omitted. Alexander Lambert (*Med. News*, July 7, 1901).

Experiments bearing on the relation of resistance to tetanus toxin in the immunized guinea-pig to the antitoxin value of its serum. The method of immunization used was to administer at intervals of four days equal doses of tetanus toxin the toxicity of which had been destroyed by means of hydrochloric acid. He compared the action of 4 such doses with the action of 8 doses. In the former case, while the animals presented a resistance to 43 minimal lethal doses, there was in the whole blood of the animal just sufficient antitoxin to neutralize between 1 and 2 minimal lethal doses. In the latter case, while a resistance of 1000 minimal lethal doses was present, there existed in the serum of the whole body only sufficient antitoxin to neutralize about 100 minimal lethal doses. Two other series of animals similarly treated gave similar results. In a further experiment, when the effect of 4 doses of modified toxin was compared with the effect of 4 doses of double the amount of toxin, a resistance of 2500 minimal lethal doses was developed in the latter, as against a resistance of 50 minimal lethal doses in the former, the antitoxin value of the sera being about the same. The general conclusion was that early in the process of immunization there was developed a very high degree of resistance, while there was very little antitoxin present in the blood. James Ritchie (*Lancet*, July 13, 1901).

Serum-therapy is well established as a prophylactic measure in spite of 5 cases of apparent failure reported by as many observers. It was used in 20 cases of wounds soiled by earth or dust, and no case of tetanus developed. An injection of 10 cubic centimetres ( $2\frac{1}{2}$  drachms) should be given on the first, third, and tenth days. If the wound does not heal promptly a fourth injection should be given on the fifteenth day. 2. The curative value of the serum may be considered under four heads as regards methods of administration: (a) Subcutaneous. Of 373 collected cases thus treated there were 145 deaths—39 per cent. In 141 of these cases the incubation period was less than 10 days and the deaths were 57

per cent. Incubation 10 days or over, 118 cases; deaths, 20 per cent. Incubation undetermined, 114 cases; deaths, 36 per cent. Some forms of tetanus were especially resistant to the serum, as shown by 15 cases of tetanus neonatorum with 11 deaths, and 15 cases of puerperal tetanus with 12 deaths. A point emphasized is that no danger is incurred by the use of serum, and enormous doses may be used with impunity. In 1 case 1800 cubic centimetres were employed. (b) Intravenous. Of 31 patients treated by this method, 18 died—a mortality of 42 per cent. This is slightly higher than by the subcutaneous method, but the method was probably reserved for the most serious cases. (c) Intracerebral. This has been followed by serious results, and is not to be recommended. (d) Subarachnoid. This is inferior to *a* and *b* in results and has an element of danger. The carbolic acid treatment of Bacelli is discussed at length, and the statement made that animal experiments show that it is not a specific remedy against tetanus. Clinically 80 cases have been observed with but 8 deaths. Most of these patients were from Italy, which gives a low mortality by all methods. Other series of cases show greater mortality. The treatment is regarded as a good symptomatic one, but not a specific. The author concludes that preventive serum-therapy possesses a sure action, and that if it were used systematically in all suspicious wounds tetanus would disappear the same as has variola under the use of vaccine. When the disease begins we are still at a disadvantage, but serum-therapy is the best treatment. The use of chloral and carbolic acid is of value in controlling spasms and should be considered an auxiliary method. It is well to employ these at the same time that the serum is given, and in view of the toxicity of the acid the preference should be given to chloral. Vallas (*Gaz. Heb. de Méd. et de Chir.*, Oct. 5, 1902; *Amer. Med.*, Nov. 8, 1902).

In two cases treated by the writer no attempt was made to maintain an equation between the amount of spinal fluid withdrawn and the amount of serum injected, the shock or collapse so often

observed following spinal subarachnoid injection of cocaine is solely due to the physiological action of the cocaine. The anatomical seat of the wound plays an important rôle in the production of the constitutional symptoms of tetanus; a favorable point for an injection of tetanus to produce constitutional effects is the space in the palm of the hand between the first and second metacarpal bones. The reaction after each injection was so prompt and improvement so positive that the author believes in the spinal subarachnoid injection of the tetanus antitoxin, preceded by withdrawal of the active, concentrated, highly toxic spinal fluid, supplemented by forced nutrition and proper care of the wound. W. H. Luckett (*Medical News*, April 18, 1903).

The general treatment of the case is quite important. The patient should be placed in a darkened quiet room. No one but the doctor and nurse should have access, and every possible source of irritation which could cause a paroxysm of muscular spasm should be rigorously excluded. The diet should be liquid, nourishment by enema being employed if the trismus is marked. Of remedies for combating the spasm chloroform is most quickly efficacious, but the relief obtained is liable to be temporary only. Nitrite of amyl will occasionally abort a paroxysm. Large doses are most usually beneficial, sometimes almost certain. Other, but less valuable, remedies are Calabar bean, the bromides, and curare. Continuous warm baths are helpful in most instances. Ice to the spine is also recommended, as is bleeding and the application of the galvanic current.

The carbolic-acid treatment of tetanus is strongly favored. The method of Bacelli is as follows: If the tetanus is of traumatic origin, the wound is thoroughly cleansed with a strong antiseptic solution (either corrosive sublimate or carbolic acid). The patient is then placed in as quiet an apartment as can be obtained, the ordinary rules of diet,



etc., are carried out, and subcutaneous injections of a 2-per-cent. solution of carbolic acid given at two- or three- hour intervals. If the case is one of only moderate severity, commencing doses of about 3 grains in the 24 hours may be used. This dose should, however, be rapidly increased to at least double or triple the quantity. Along with the carbolic acid other remedies, as morphine or chloral, may be given, as thought necessary. From the study of Italian literature, it would seem that: 1. Carbolic acid gives better results in tetanus than does the antitoxin treatment. 2. It acts by antagonizing the toxin and by quieting the nervous system. 3. It should always be given hypodermically, and in large-enough doses, cases of tetanus being remarkably tolerant toward it. 4. Other methods of treatment should be continued, of which the discoverer lays special stress on the local disinfection of the wound. H. C. Wood, Jr. (Merck's Archives, May, '99).

Large doses of carbolic acid curative in the tetanus in horses. One drachm of carbolic acid is injected every two hours for the first thirty-two hours of treatment, and less frequently as occasion may arise afterward. Within an hour there is a large swelling at the seat of injection, the neck and shoulders, which gradually subsides during convalescence. Sometimes in the case of the injections made during the subsidence of the disease there is temporary loss of hair. Never less than 16 drachms administered in a successful case, while administration by the mouth of  $\frac{1}{2}$  ounce of diluted carbolic acid caused death. In tetanus there is probably a specific tolerance of the acid. Place (Lancet, Feb. 24, 1900).

Case of tetanus in which subdural injections of antitoxin led to no appreciable reaction, while, twenty-four hours later, opisthotonos set in, with marked cyanosis. Hypodermic injections of 5 drops of pure carbolic acid in 15 drops of water every three hours were then used. On the tenth day the symptoms moderated, and on the twenty-fifth, the patient was able to sit up and finally recovered. T. Clifford Allbutt (Phila. Med. Jour., Mar. 17, 1900).

Case of traumatic tetanus in which severe symptoms developed soon after injury. Ten drops of a 10-per-cent. solution of carbolic acid were injected hypodermically; in a few minutes 15 drops more; then 30 drops. The dose of 30 drops was repeated every half-hour all day and night. The second day the same dose was injected every two hours, and on the third day a drachm of the same solution was given in glycerin *per os*—three times during the day. On the third day the patient was able to swallow, and then recovery was rapid and complete. Flavel Wood (Revista de Med. et Chir., Aug. 20, 1900).

Wasserman—reasoning from the assumption that destruction of the nerve-cells in the cord and brain during tetanic convulsions or toxæmia might underlie the immunity thus conferred—discovered that the liquid obtained by rubbing up fresh brain or spinal cord with normal salt solution had the power of conferring a temporary immunity, and could even neutralize the effect upon lower animals of an injection of tetanic toxin ten times larger than would, under normal conditions, cause death.

It is possible to render animals immune against tetanus by injecting a culture of Fraenkel's pneumococcus. It was found that the action of tetanic poison on an animal already inoculated shortens the period of immunity of Fraenkel's pneumococcus. The immunity conferred by injection of pneumococcus differs from that produced in other cases by the extreme rapidity of its action; if employed a short time before or even at the same time as the more severe poison, it is still able to act quite efficaciously. This material loses its power and becomes almost inactive against tetanus poison, although it seems to retain its own power of conferring immunity against its own original bacillus. Tizzoni (Gazz. degli Osp., Mar. 6, '98).

Local surgical measures, such as excision of the wound or scar or thoroughly cauterizing the same, are usually advised and should be employed early, and in

any case if evidence of wound irritation appear, thorough cleansing and other antiseptic precautions being resorted to.

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Mobile.

**THIOL.**—Thiol is a substance composed of hydrocarbons and about 12 per cent. of sulphur. As prepared by Riedel, it occurs as a soft, gray powder or scales; it also occurs in a liquid form containing about 40 per cent. of thiol. The liquid occurs as a thin, brownish-black neutral fluid having the odor of oil of birch. It is readily soluble in water, but less soluble in alcohol and ether, forming a clear mixture which is rendered more perfect by the addition of glycerin. It is free from local irritant effect. Thiol resembles ichthyol in chemical composition, and is said to produce similar physiological and therapeutic effects. It is said to be non-toxic and is preferred as an antiseptic and local stimulant to ichthyol on account of its more agreeable odor.

Schemmer reports cases of herpes zoster and dermatitis herpetiformis successfully treated with a 10-per-cent. solution of thiol used twice daily. He recommends it in other erythematous disorders.

Moncorvo has employed it among children for the purpose of diminishing supuration and removing cutaneous affections, either of parasitic nature, such as tinea and favus, or those due to constitutional disease, such as tuberculosis and syphilis.

Thiol can be used in inflammations of every description. Infiltrations are resorbed without the formation of pus, making incision unnecessary. In severe carbuncles, after removal of the pus, thiol allays inflammation when applied around the wound on the infiltrated parts, and pain ceases entirely.

Lymphangitis, even phlegmons caused by panaritium, insect-bite, and other

causes, quickly disappear under thiol treatment. The best results are obtained with liquid thiol as supplied by the manufacturers, not with that prepared from powdered thiol by the addition of water. Wirz (*Deut. med. Woch.*, July 1, '97).

Thiol is most valuable in gouty or rheumatic sore throat on account of its large proportion of sulphur. W. A. Wells (*Phila. Med. Jour.*, Apr. 15, '99).

Constipation has been relieved by daily doses ( $\frac{1}{8}$  grain) of thiol.

Gottschalk found thiol beneficial in cases of pelvic exudation and in acute and chronic endometritis. He employed a 10- to 20-per-cent.-glycerin solution upon vaginal tampons, and gently rubbed the abdomen once a day with a thiol ointment. He applied the remedy to the cervical canal, using an applicator wrapped with cotton.

Thiol ointment is an irritant to the skin, and its occasional discontinuance is advised.

In moist eczema, scrofulosis of the skin, and in syphilides thiol has been used with advantage. In cases of moist eczema the skin is first washed with an antiseptic solution and thiol is then dusted on in the form of powder.

Thiol has been found very useful in the treatment of burns, where it acts as a desiccant, relieves the pain, hardens the skin, and hinders the growth of micro-organisms if any be present. (Bidder.)

In eczema, erythema, erysipelas, and lupus a 10-per-cent. ointment is advised (liquid thiol, 1 part; vaselin, 2 parts; lanolin, 7 parts; mix).

## THORAX AND THORACIC VISCERA, INJURIES OF.

### I. Mural Injuries.

**Contusion of the Chest.**—The discrepancy often observed between cause and effect in the matter of contusions of the chest is only one degree less notable



than in the case of abdominal or cerebral contusions. Given an individual case, it is impossible to predict, with any degree of certainty, in what degree the symptoms resulting from the blow, fall, or crush will be, simply those of a local contusion, or those of shock or concussion. Compare, for example, the immediate death of a well-trained pugilist from a blow "over the heart" delivered in a friendly bout, with Paré's case: a child whose chest was run over by a "carriage containing five men," without even producing a fracture. It is therefore necessary to accept the clinical picture of each case as it occurs and to strive to differentiate the symptoms of shock—the effects of which may be severe, but are usually transient—from those of injury to the viscera; and more especially to recognize injuries to the viscera which may be overshadowed by severe shock, or disguised by the mildness of the symptoms.

Case of a young man, 28 years of age, of vigorous constitution, who received a severe fall from a bicycle. At the time he was going at good speed, and some portion of the tubing, probably the handle-bar, came violently in contact with the chest. The skin was not torn, but there was a slight depression as though the costal cartilage had been fractured. At the post-mortem examination there was found some laceration of the intercostal muscle; the pericardium was intact, but was distended with dry, clotted blood. Examination showed a transverse rent at the apex of the right ventricle, extending through its wall.

Rupture of the heart, with contusion, without penetration of the chest-wall, is a rare accident. A collection made by Cecil Robinson, in 1897, showed a total of twenty-two cases. R. C. Newton (Med. Rec., June 17, '99).

The LOCAL, SUPERFICIAL SYMPTOMS of contusion of the chest are unimportant. The comparatively slight hæmatoma and comparatively severe and pro-

longed soreness alone deserve mention. This soreness may combine with the patient's fright to produce an alarming, but temporary, dyspnoea, and it may, in the middle aged, drag on for months as a pain of rheumatic or neuralgic type.

The SYMPTOMS OF SHOCK are present to a greater or less degree in almost all cases. The pallor, weakness, syncope, or temporary intellectual confusion, and so forth, are not peculiar to thoracic injuries. Yet what might be termed "local shock"—shock to the heart, namely—may seriously interfere with the action of that organ, even proving fatal, as in the case cited, without causing any appreciable lesion.

From research into the cause of collapse or death from blows upon the lower chest and the epigastrium upon animals, it is found that collapse or death may be caused wholly independently of the vagi, though the vagi probably slightly contribute to the result.

Collapse or death from violence applied upon the lower chest or abdomen are due mainly to the loss of rhythmical contractions from the mechanical irritation of such violence on the heart-muscle itself. There is evidence tending to show that the vagal terminal mechanism in and near the heart may contribute to the result, but in a minor degree. G. W. Crile (Phila. Med. Jour., Mar. 31, 1900).

The SYMPTOMS OF "INTERNAL" INJURY are so bound up, clinically, with the symptoms of simple contusion that they deserve some notice here. Whenever a patient receives an injury to his thorax sufficient to disable him for the time being, he should be kept in bed and his symptoms, as well as the physical signs of his lungs, carefully noted for several days until the physician feels assured that no pleurisy or bronchitis will develop as a result of the injury. To discharge a patient as cured and to have him return, or worse still, apply elsewhere, with a chest full of serum, is

not delightful. Needless to say, the patient—whether conscious or not—should be immediately examined for signs of injury to the heart or lungs and fracture of the ribs or sternum.

**PROGNOSIS.**—The prognosis of uncomplicated superficial thoracic contusion is entirely favorable. Recovery is rapid in the young, tedious in the old and rheumatic. Yet, clinically speaking, the prognosis must always be guarded until the passage of three or four days without evidence of internal injury confirms the diagnosis.

**TREATMENT.**—Slight contusions may be treated by the adhesive-plaster splint, applied as for fracture, or massage with alcohol, witch-hazel, or chloroform liniment, according to the fancy of the physician.

Severe contusions, if the symptoms of shock are marked, require active stimulation by external heat, strychnine, whisky, enemata, etc., and absolute quiet. Morphine is a specific in such cases, by relieving pain, quieting the mind, stimulating the heart, and slowing respiration. The patient should be moved and handled with the utmost gentleness, so as not to aggravate possible internal injuries, the existence of which cannot be ruled out with certainty during the first hours. If the patient responds to the stimulation recovery is quite rapid, unless there are internal injuries. The usual rules of diet, catharsis, and diuresis carry the patient through his convalescence. The lungs and heart must be examined at least every other day until the patient is discharged.

**Fractures and Dislocations.**—The fractures and dislocations of the various bones of the thorax have already been described (see FRACTURES AND DISLOCATIONS). They are of importance in this

connection from a negative point of view: because, like fractures of the skull, their relation to injury of the contained viscera is by no means constant. The significance of fracture of the ribs—the usual osseous lesion—is commonly overestimated. A surprisingly small percentage of those whose ribs are broken suffer any visceral injury, while an astonishingly large proportion of those who suffer more or less serious, even fatal, rupture of the lungs or heart show no lesion of the thoracic cage whatever. Thus, among Fischer's 76 cases of rupture of the heart, 32 showed no evidence of fracture. The explanation of this apparent paradox lies in the great elasticity of the thorax, especially in the young (it decreases with advancing age). Weisserer claims that up to the age of twenty-five the sternum can be pressed back to touch the vertebral column without injury to the ribs. Thus in the young, in those, namely, who are exposed to the greatest number of injuries, the force is transmitted through the bones to the viscera, while in the adult and aged the bones are more likely to break.

An interesting comparison has been personally made between man and other animals in respect to the shape of the thorax in determining the effect of direct and indirect force in producing fractures of the ribs. The conclusion is that the lesser curve of the ribs with increased strength in quadrupeds is a factor of safety greater than the greater curve and increased elasticity in man. Still, the ribs of quadrupeds may be broken by both direct and indirect violence, while in man indirect force more often leads to fracture, the ribs only being driven in at the place struck, the fracture occurring a little way off. It is thought that this explains the comparative absence of injuries to the deeper-lying structures, such as would naturally be expected to occur, from direct violence. E. M. Corner (*Lancet*, Jan. 7, '99).



Yet it cannot be denied that a fragment of bone, whether detached or only momentarily depressed, is often the immediate cause of visceral rupture. But these cases differ clinically in no way from those in which there is no fracture, excepting rupture of the pleura.

**RUPTURE OF THE PLEURA** is the only complication of fracture essentially due to the fracture. By rupture of the pleura is meant rupture of its parietal leaf, without rupture of the visceral pleura or the underlying lung. Such a rupture only occurs from a direct tear by the end of a broken rib. When, after an injury, fracture of a rib and hæmothorax can be demonstrated, and hæmoptysis, pneumothorax, and emphysema do not occur, it may be fairly concluded that the hæmothorax is due to rupture of the pleura. The treatment is that of hæmothorax.

**Non-penetrating Wounds.**—The only importance attached to non-penetrating wounds of the thorax lies in the differential diagnosis. As soon as it is certain that the wound actually is non-penetrating the prognosis and treatment are simply those of flesh wounds elsewhere. In establishing the diagnosis the course to be followed is the same as in contusion, viz.: absolute rest until the integrity of the viscera can be guaranteed.

There is one symptom, a slight emphysema about the wound, which sometimes occurs in wounds of the axilla, that might lead to confusion in the diagnosis, though in reality it is due to suction of the air into the loose axillary fascia by the movements of the arms. But a mere knowledge of the fact suffices to distinguish this emphysema from the emphysema of wounds of the lung.

Probing as a means of diagnosis or treatment is absolutely to be condemned.

**TREATMENT.**—The non-penetrating

wounds of the thorax are to be treated on general surgical principles. Hæmorrhage from an intercostal artery was one of the nightmares of ancient surgery. It may be controlled by clamp or pressure, and the surgeon need not hesitate to enlarge the wound for this purpose.

## II. Injuries of the Thoracic Viscera.

**Injuries of the Pleura.**—Injury to the vesical pleura is a feature of injury of the lung, which clinically always accompanies it. Injury to the parietal pleura may be subdivided into:—

1. Rupture by a fractured rib (see above).

2. Wounds of the pleura.

**WOUNDS OF THE PLEURA.**—Perforations of the pleura containing fluid have been recorded as curiosities of surgery. Such an accidental paracentesis has a romantic rather than a scientific interest.

Puncture or incision of one layer of the pleura without injury to the other is, as may well be imagined, an unusual occurrence, and perhaps it might be more correct to speak of wounds of the pleura with a corresponding lesion in the lung too slight to produce symptoms. Be that as it may, cases do occur which give evidence of injury to the parietal pleura alone.

When the wound is so small as not to admit the entrance of any air the condition is practically a rupture of the pleura, and the consequent hæmothorax is the sole evidence that the pleura has been damaged.

In the majority of cases, however, the wound is large enough to allow the normal suction, the "vacuum" of the pleural cavity, to draw in the outside air, and thus to produce a pneumothorax or a pneumohæmothorax. Such a case differs from a wound of the lung only in the absence of hæmoptysis. If the wound is larger still, the uninjured lung may be

seen fluttering wildly about, or a hernia of the lung may occur.

It is probable that the secondary pleurisy with effusion, which so often complicates a contusion or wound of the thorax, however slight, is due to some puncture, rupture, or contusion of the pleura, but what the exact nature of the lesion may be it is impossible to say.

The diagnosis between an injury to the pleura alone and one to the lung is generally unnecessary, often impossible.

The prognosis and treatment are along the same lines as those of pulmonary injuries.

### Rupture of the Lung.

SYMPTOMS.—The evidence of pulmonary rupture may be more or less marked.

*I. When the lung is only slightly torn or contused*, a small hæmoptysis may be the only sign added to the evidences of superficial contusion. There may be a few fine râles at the point of injury, or a circumscribed area of dullness, with little alteration of voice and breathing. In other cases these initial signs pass unnoticed, and the first evidence that the lung has been injured is a pleurisy with effusion, a bronchitis, or a broncho-pneumonia (see Section V of this article).

*II. When the pulmonary laceration is extensive* there is immediate hæmorrhage into the bronchi, and hæmoptysis is instant and copious. The shock is severe and the patient in collapse, with thready pulse, labored and irregular breathing, and subnormal temperature. Physical examination of the injured lung reveals evidences of pneumohæmothorax (see below).

Study of 94 cases of thoracic injuries, caused by penetrating and incised wounds. In 60 patients the left, and in 32 the right, pleura was penetrated, while in 2 both pleuræ. In 2 the arteries of the chest-wall were injured, necessitating

ligation. In one patient the thoracic duct was injured. Pneumothorax complicated all but 4 cases, and there was no indication that it, in itself, is a serious complication. Subcutaneous emphysema was observed in 47 patients. Hæmothorax occurred in 27 patients, developing into pyothorax in 14. In the diagnosis of obscure cases of thoracic wounds, enlarging the wound is the only means of ascertaining the degree and extent of penetration. Finkelstein (Bolnit. Gaz. Botkina, July 10, 1902; Phila. Med. Jour., Jan. 3, 1903).

During the first twenty-four hours the patient may die of shock, loss of blood, or by drowning in his own blood, which fills the trachea and may even run into the bronchi of the uninjured lung. That shock is always severe is explained by the number of agencies at work to cause it: there is the "molecular disturbance" of the trauma, the profuse internal hæmorrhage, and—most of all—the shock of sudden pneumothorax, which arrests the functions of one lung almost instantaneously, and, at the same time, disturbing the normal thoracic tension, seriously hampers the action of the other lung and the heart.

If the patient survives a few hours, subcutaneous emphysema begins to appear at the base of the neck, or, if the parietal pleura is torn by a broken rib, at the site of injury (see below, EMPHYSEMA).

Associated injuries may prevent a given case from conforming closely to the type; but the elements of the picture—hæmoptysis, pneumohæmothorax, and secondary emphysema—cannot be obscured.

Probing is not always satisfactory, and it is more advisable to enlarge the wound and determine its depth with the eye. In case a rib or cartilage is in the way resection should be resorted to only when there is hæmorrhage from an intercostal artery and when the source is



otherwise inaccessible. When satisfied that the wound penetrates the pleura, an antiseptic tampon should be introduced into the chest-cavity. If there are no contra-indications it should be left *in situ* for four or five days. In the cases in which the wound was sutured the procedure proved unmistakably harmful in 50 per cent. Complications should be treated on general principles. In case of hæmothorax the chest should be opened with a trocar or by resection of a rib. In progressive emphysema an outlet should be made for the air in the pleura. B. K. Finkelstein (Botkin's Gaz., St. Petersburg, Nos. 19 and 28, 1902).

The course of the case, after the first shock has been passed, is that of a pneumothorax, with a marked tendency to secondary inflammations of the lung and pleura (see COMPLICATIONS).

**ETIOLOGY.**—Accurately speaking, rupture of the lung is the bursting of that organ by a compressing force, but clinically this true rupture is indistinguishable from laceration of the lung by a fractured rib (see above). In the majority of cases the ribs are broken. Less often they remain intact. The accepted explanation of rupture of the lung under these circumstances is that of Gosselin: the patient, foreseeing his danger, instinctively catches his breath, thus presenting a tense lung, which breaks readily under a crushing force. Yet this theory does not apply to all cases, notably those who are unconscious when injured, nor need it be invoked in any case. Doubtless a distended lung is more easily torn than an empty one; but the fundamental fact is that when any part of the lung is suddenly compressed, not only is it contused as any other soft part would be, but the circumference of the lung, closely adherent to the chest-wall by virtue of the pleural vacuum, is torn directly at the point of impact or indirectly at some other point, quite as a paper bag distended with air

(though the lung is distended by suction from without rather than by pressure from within) is torn by a blow of the fist.

In point of fact, rupture of the lung is usually caused by a severe crushing force, such as a fall from a height, the fall of a rider under his horse, a fall under the wheels of a wagon, or the kick of a horse.

**PATHOLOGY.**—By extensive rupture of the lung-tissue an artificial cavity is formed, connecting the pleural cavity, the bronchi, and the torn blood-vessels, thus establishing pneumohæmothorax. Lesser ruptures form small hæmatomas or ecchymoses, like contusions of any soft part. If the healing is not interfered with by infection or a large hæmatoma, it is complete within a few days. Autopsy has shown complete healing of small lacerations within a week.

**PROGNOSIS.**—The prognosis depends on the reaction of the vital forces of the individual to the injury received, and, hence, given individuals of the same age, habits, and constitution, the less the injury, the brighter the prognosis. Yet in any case of injury to the lung, however slight, the prognosis must be guarded until the lapse of time has proved that the secondary complications are not to be feared (see Section V of this article).

**TREATMENT.**—The treatment at the time of accident is the same as that of severe superficial contusions of the chest (which see): stimulants, morphine, physical rest, and external heat.

The subsequent treatment is that of the primary and secondary complications, and is reviewed in Sections III, IV, and V.

### Wounds of the Lung.

**SYMPTOMS.**—Wounds of the lung present the combined features, already de-

tailed, of rupture of the lung and wound of the pleura. The smaller the wound, the more its clinical picture resembles that of simple rupture of the lung. The larger the external wound, the more it resembles a simple wound of the pleura. Air and blood intermingle in the pleural cavity from the lung and from the parietal wound. If the latter is small or tortuous, the air from the pleural cavity may infiltrate along the fascial planes about the wound (see Section III), while, if the external wound is large, instead of this subcutaneous emphysema there is "traumatopnœa": a rush of air in and out of the wound each time the patient breathes.

The subsequent course of a wound of the lung is quite that of a ruptured lung; but added to the danger of hæmorrhage and sepsis from within is the danger of hæmorrhage and sepsis from without.

In hæmothorax from penetrating wounds of the chest, the diagnosis lies between an injury to a large or a small vessel and the integrity of the thoracic organs. When the respiration cannot be heard behind and laterally at a line passing through the scapula, and when this is accompanied by a tympanitic note above, when there is a pulse of from 110 to 120 and a cold sweat, a large vessel has been injured and a bronchus of some size has been invaded. When, on the other hand, the respirations are not increased above 25 or 30 to the minute, and the flatness is limited to the base of the lung posteriorly, the pulse being below 105, the hæmothorax is limited and a small vessel has probably been cut. Bartoli (*Gaz. Hebdom. de Méd. et de Chir.*, Apr. 29, 1900).

**TREATMENT.**—The treatment of a laceration of the lung and its consequences are considered elsewhere (see **RUPTURE OF THE LUNG**).

The added dangers, sepsis and hæmorrhage from the parietes, require local

therapeusis. On seeing the patient the surgeon's first efforts are directed to insuring his rest and stimulation, and at the same time he treats the wound in the thoracic wall as an ordinary surgical wound, endeavoring to obtain asepsis by the removal of foreign bodies and copious irrigations with sterile solutions, and hæmostasis by pressure or ligature.

As regards asepsis, it must be remembered that under ordinary circumstances all endeavors to attain it shall stop short at the parietal wound and respect the pleural cavity, for irrigation of the latter is calculated to do more harm by increasing the shock and renewing or encouraging the internal bleeding than it can possibly do good. For the same reason the solutions used to wash the wound should be simply aseptic, and not antiseptic, so that the portion of them which is lost within the thorax may not be irritating.

As to hæmorrhage, patients have died of bleeding from a wounded intercostal or internal mammary artery. Hence the surgeon should not be satisfied until he is absolutely certain that all parietal hæmorrhage is checked.

Whether or not the wound shall be sutured at once is not always easy to decide, but the rule is to suture if possible, and to exercise especial care in obtaining apposition of the deeper structures so as to prevent any extensive emphysema about the wound.

The treatment of hernia of the lung, etc., is referred to in another section.

**BULLET WOUNDS OF THE LUNG.**—Bullets make small, perforating wounds in the lung. The looseness of the tissue prevents their having any explosive effect. They usually cause death by hæmorrhage, and they form a large percentage of the foreign bodies of the lung.



**Rupture of the Heart and Pericardium.**—The so-called “spontaneous” rupture of the heart is, like a “spontaneous” fracture, the rupture of a diseased organ by a very slight trauma. The usual causes of spontaneous rupture of the heart are myocarditis, the predisposing cause, and a violent contraction of the heart due to a shock, such as fright, or to great muscular effort.

The usual cause of rupture of the heart is a heavy blow over the sternum. The bones are unbroken in 42 per cent. of the cases (Fischer). In 5 of 76 cases the heart alone was ruptured, in 5 others the pericardium alone. The rupture is very rarely incomplete.

**SYMPTOMS.**—The usual symptoms are collapse and immediate death. If death is not immediate, the diagnosis may be made by the evidences of irregular heart-action and fluid in the pericardium. Of the 7 cases reported by Fischer as having recovered, in only 1 was the diagnosis confirmed by subsequent autopsy.

It is important from a medico-legal point of view to remember that death is not always instantaneous in cardiac rupture. Kelynack (*Lancet*, July 18, '96).

**TREATMENT.**—See WOUNDS OF THE HEART.

**Wounds of the Heart and Pericardium.**—Practically all wounds of the heart are bullet and stab wounds. Lacerations by broken bones are included under rupture of the heart.

Fischer's statistics prove that the most important parts of the heart functionally, the ventricles, are much more liable to wounds than the auricles: 257 wounds of the ventricles, against only 31 of the auricles, which might be expected from the smaller size and less exposed position of the latter. Editorial (*Jour. Amer. Med. Assoc.*, June 13, '96).

**SYMPTOMS.**—As a rule, a wound of the heart is immediately fatal: the wounded

man drops dead incontinently. Yet in a few cases the fatal issue is postponed or averted, and foreign bodies have been found imbedded in the wall of the heart, though they produced no symptoms during life.

The few who escape immediate death are usually found in a condition of collapse: the product of shock and hæmorrhage. But some persons, among whom the late Empress of Austria was a notable example, escape this shock and continue to walk, fight, or go about their various avocations for a few moments or even for a few days or weeks, at the end of which time the heart suddenly stops.

If the patient survives the immediate shock, examination of the chest reveals the external wound bleeding copiously if in direct communication with the wound in the heart. The area of cardiac dullness is enlarged by an effusion of blood within the pericardium (hæmopericardium), or perhaps obliterated if the pericardium is filled with air (pneumopericardium) from an adjacent wound in the lung and pleura, in which case there is pneumohæmothorax. Auscultation reveals a weak, irregular heart-action and numerous atypical murmurs. A special sound heard with pneumopericardium or pneumohæmothorax in the vicinity of the heart is the “mill-wheel sound.” This is a succussion caused by, and synchronous with, the heart's action.

The immediate danger of death is now from hæmorrhage, associated injuries, and from compression, actual smothering, of the heart by the blood in the pericardial sac. Escaping these dangers, fatal embolism, secondary hæmorrhage, and infection are still possible; and, if the patient finally does survive, the heart may be permanently debili-

tated by pericardial adhesions, cicatrices about the valves, perforation of the interventricular septum, etc.

Fischer, who chronicles 334 wounds of the heart, exclusive of rupture, and 42 of the pericardium alone, records 47 recoveries (14 per cent.) in the former class and 18 (42 per cent.) in the latter. While these figures are misleading as to the proportion of recoveries, they show that recovery is possible.

DIAGNOSIS.—The history and evidence of a wound in the præcordial region, together with marked irregularity of the heart's action and increase in the area of cardiac dullness, or rarely obliteration of it with "mill-wheel" succussion, those, together with severe shock, usually constitute the diagnostic features of a wound of the heart.

Here, even more than in wounds of the lung, the use of the probe is bad surgery. It can reveal nothing that may not be discovered in some other way, and it may kill the patient.

PATHOLOGY.—When instantaneous death follows a wound of the heart it is probably due to the shock inflicted on the automatic heart-muscle and its contained ganglia, in response to which it stops instantly.

The aseptic healing of a wound in the heart requires a week. The blood effused in the pericardium may become infected or be absorbed, leaving an adhesive pericarditis.

The bullet wounds of the modern rifle have a special pathology. If they so much as graze the heart they impart to its fluid contents such a rapid vibration as to burst the organ asunder.

TREATMENT.—Up to within a few years the treatment of lesions of the heart has been similar to that of injuries of the lung, supporting and expectant; but the accumulated evidence in favor

of paracentesis pericardii has at last emboldened the surgeon to attack the heart itself.

It has been proved that a large proportion of those who survive an injury to the heart a few hours or days die either from loss of blood or compression of the heart by the blood effused within the pericardium. Theoretically either of these dangers can only be met by an operation, and practically a very fair number of successful operations bids us hope that in the future a satisfactory percentage of successes may be reported. At present it does not seem justifiable to operate except in those rare cases when the patient is evidently failing rapidly and yet not moribund at the time of operation.

The technique is described in Section VI.

The later dangers of infection are met by the routine treatment of septic wounds—drainage, wet dressings, irrigation, etc.—and of suppurative pericarditis, mediastinal abscess, etc., as the case may be.

The pericardium and heart are not regions where surgical intervention is always contra-indicated. Before intervention is attempted the condition of shock that is generally present must be overcome. This is accomplished by the intravenous injection of physiological serum and other fluids. Intervention should not take place while the heart is weak, and nothing should be done to enfeeble it. Anæsthetics should be avoided or used only in a very slight amount, without full anæsthesia.

The method of intervention is influenced by the form of injury that requires it. If the injury is of the nature of a puncture or prick as by a needle, the foreign body should be removed. If the volume of the foreign body is greater it is better to operate where everything is in sight rather than to trust to the closure of the wound by a contraction as the body is gradually withdrawn. The



pericardium and, if necessary, the heart is laid bare, sutures are placed in position, the foreign body removed, and the wound closed immediately by drawing the sutures.

Where an incised wound of the heart is suspected the symptoms must be the guide. Secondary intervention has succeeded in a number of cases, and intervention must be postponed till the symptoms indicate the necessity. The complications to be watched for are hæmorrhage and pericarditis.

In hæmorrhage immediate intervention is never indicated, as spontaneous arrest often cures. Therefore, if the area of pericardial dullness remains stationary and does not increase, expectant treatment is indicated. When, however, there is an aggravation of the general condition, with pallor, weak pulse, syncope, an augmentation of præcordial dullness, weakening of the sounds of the heart, and recurrent external hæmorrhage, intervention is indicated. When possible the track of the wound should be examined before opening the pericardium. Cestau (*Gaz. Heb. de Méd. et de Chir.*, No. 17, '98).

Ninety cases of wounds of the heart and pericardium, in which the lesion was discovered during operation or at the necropsy, tabulated. In 70 cases death occurred without intervention, 56 from internal hæmorrhage, 12 from infection, and 2 from cerebral hæmorrhage. The nature of the instrument causing the wound is reported in 78 cases; nearly all of them were penetrating wounds from small arms; 48 of them from a knife. The right ventricle was injured in 31 cases, the left ventricle in 26 cases, the right auricle in 6 cases, and the remaining cases were of the left auricle, great vessels, and unclassified. In 45.5 per cent. of the cases there was also a wound of the pleura, and in many of the other cases other organs were injured. Pericardotomy followed by tampon of gauze was practiced in 3 cases, with cures in all. Eight pericardotomies followed by suture of pericardium were followed with 3 recoveries and 5 deaths. In 5 cases in which wounds of the heart were sutured followed by packing or suture of

the pericardium there were 2 cures and 3 deaths, one of them from an independent cause. The time intervening between the accident and death varies from some minutes to several hours. E. Loison (*Revue de Chir.*, Feb. 10, '99).

Clinical experience has shown that wounds of the heart are not so grave as is generally supposed, and that recovery may follow even a wound extending into one of its cavities.

Death in most instances of fatal heart injury is due to hæmorrhage. The most urgent danger, however, in cases of penetrating wounds of the heart, especially those of the ventricles, is shock due not so much to anæmia as to direct irritation and disturbance of the wounded organ. This condition of shock should be treated not by the application of stimulants, but by prompt intervention of the surgeon in enlarging the wound in the pericardium, in removing clots from this sac, in exploring the injured heart, and in closing the wound of its wall by suture. Another but less frequent cause of death in cases of wounded heart is the entry of air into the wound and consequent gaseous embolism.

Surgical intervention is indicated just as much in simple wound of the pericardium as in an injury involving both this membrane and the wall of the heart. The technical difficulties are very great. A flap of the thoracic wall—including the left half of the lower extremity of the sternum and the third, fourth, fifth, and sixth costal cartilage—recommended. Podrez (*Rev. de Chir.*, May, '99).

Experiments upon rabbits show that they bear the introduction of a needle into an unexposed heart better than when the heart has been exposed. Review of the surgery on the subject shows that a needle introduced into the human heart must be immediately extracted, and that exposure of the heart for its removal will not always be necessary. After the first few days exposure of the heart will be dangerous. The needle can, however, under favorable circumstances remain in the heart. To extract larger foreign bodies, the heart must be exposed. V. Oppel (*Archiv f. klin. Chir.*, lxxiii, No. 1, 1901).

A review of cases of stab wounds of the heart justifies the following conclusions:—

1. The time has arrived when a wound of the heart should be operated on with as little hesitation as a wound of the brain, with the expectation, under corresponding conditions, of getting equally good results. The mortality must inevitably be high,—not from the operation, but from the injury,—especially if all cases, including desperate ones, be undertaken. Selection of cases who have survived five or more hours after receiving the wound would give a good percentage of recoveries, but such selection is not to be recommended.

2. In all cases of wounds in the region of the heart, with symptoms threatening life, an exploratory operation should be done by making an osteoplastic flap by dividing the fourth and fifth costal cartilages at their attachments to the sternum and the ribs about one inch external to their attachment to the cartilage, somewhat according to the method of Roberts. This flap turned up as a door on a hinge gives a good view of the pericardium and can easily be enlarged upward if more room is required.

3. While early and speedy operation is often essential to success, yet the importance of asepsis cannot be too strongly emphasized on account of the great danger of pericarditis and empyema. If there has been much hæmorrhage a quantity of physiological salt solution, approximately equal in amount to the blood lost, should be injected into a vein while the surgeon is operating on the heart if it has not been done sooner. George Tully Vaughan (*Medical News*, Dec. 7, 1901).

After the first shock of the bullet wound directly in the sternum had subsided, the patient, a robust young man, was comparatively comfortable for three weeks, during which the bullet had probably been ensconced in the wall of the heart. At this date it penetrated into the heart, and the most violent arrhythmia followed for a time. Radioscopy showed the bullet in the heart, tossed about in the blood stream. By the end of six months the bullet had

become stationary, and there was scarcely a trace of arrhythmia. Experiments on dogs confirmed the assumption that the prognosis is not affected when the foreign body heals in the heart without trace of reaction. None of the dogs succumbed, although foreign bodies of various sizes had been introduced into the heart. O. Riethus (*Deutsche Zeitschr. f. Chirurgie*, vol. lxvii; *Esmarch Festschrift*; *Journal American Medical Association*, June 20, 1903).

**Foreign Bodies in the Heart.**—As a rule, the lodgment of a foreign body in the pericardium or heart, whether by trauma or ulceration, is rapidly and irretrievably fatal. Exceptionally, however, some individual evidences this condition unconsciously for a number of years, and dies of intercurrent disease.

In general, the prognosis is quite as fatal as for other wounds of the heart.

The extent of the wound does not seem to bear any decided relation to the duration of life, for while Steiner's experiments seem to prove that simple puncture by a needle is not very dangerous, yet several cases are on record of immediate death resulting from needle wounds, accidental, homicidal, or otherwise. Again, in the cases where recovery took place the damage was much greater than any that could be inflicted by a needle. In Brugnoli's case the mitral valve was implicated; in Conner's case, one cusp of the aortic valve; yet the patients survived for years. Editorial (*Jour. Amer. Med. Assoc.*, June 13, '96).

**Injuries to the Mediastinum and Thoracic Vessels.**—Rarely existing alone, these injuries often complicate injuries of the heart or lung, obscuring their symptoms and depressing the prognosis. When the great vessels are injured, immediate and fatal hæmorrhage results. Such later complications as aneurism and mediastinal abscess have been described elsewhere.



Wounds of the thoracic duct, while they prove fatal through leakage of the chyle, are said to heal if the duct is not completely divided on account of the unusual elasticity of its walls.

Reports of 9 cases of wounds of the thoracic duct have been collected from literature. Personal case which occurred during a secondary operation for removal of cancerous glands in the neck.

As a rule, the thoracic duct lies beyond the reach of operative injury. The most important anomaly from a surgical stand-point is an arching of the duct high up into the neck.

The treatment of injuries to the thoracic duct occurring during operation, may be summed up as follows:—

“When working near the duct all visible lymphatics should be tied.

“If the duct itself is injured, suture is the ideal method.” If this is impossible and the duct wounded seems to be the main branch, a provisional ligature should be applied and the wound tamponed with gauze. If the leakage should become uncontrollable and threaten starvation, the provisional ligature should be tried. H. W. Cushing (*Annals of Surg.*, June, '98).

### III. Primary Complications.

#### Hæmorrhage.

VARIETIES.—1. *External hæmorrhage*.—This merits no extended notice. External hæmorrhage, whether slight or profuse, may come from a visceral injury, quite as internal hæmorrhage may come from a parietal vessel.

2. *Internal Hæmorrhage*.—The blood may be effused into (a) the bronchi [causing hæmoptysis], (b) the pleura [hæmothorax], (c) the pericardium [hæmopericardium], and (d) the mediastinum [hæmomediastinum]. Any or all of these manifestations of bleeding may result from a single injury.

SYMPTOMS.—The general symptoms of internal hæmorrhage are the symptoms of a rapid loss of blood plus those

of the attendant shock, viz.: collapse, usually syncope, with ever-increasing anæmia and progressive weakening of the pulse, in spite of the most energetic stimulation. To this not overdefinite clinical picture are added, when the hæmorrhage is intrathoracic, certain characteristic physical signs. An *hæmoptysis* is the most frequent, and the most notable evidence. It may be distinguished from hæmatemesis by the presence of râles in the bronchi of the affected lung (perhaps in both), the history of injury to the chest, and the light color of the blood as well as its admixture with air. *Hæmothorax* stands next in importance. It produces the same physical signs as pleurisy with effusion (which see), unless there is a simultaneous irruption of air into the pleural cavity, in which case the signs are those of pneumohæmothorax (see below). *Hæmopericardium* increases the area of cardiac dullness and interferes with the action of the heart quite as a serous pericarditis does. Finally *hæmomediastinum* produces physical signs similar to those of abscess (see MEDIASTINUM).

DIAGNOSIS.—The diagnosis is rarely doubtful. It may always be settled by paracentesis of the pericardium or pleura (see below). But the point of origin of the hæmorrhage may be difficult to determine. On this point a few fundamental rules may be laid down.

1. If there is hæmoptysis, there are usually more râles in the injured lung than in the sound one.

2. If there is hæmothorax or pneumohæmothorax without hæmoptysis, the lung is intact and the bleeding parietal usually.

3. Hæmopericardium is no proof that the heart itself is wounded.

4. Never remain in doubt whether there is bleeding in the chest-wall. Be

assured by actual inspection that there is no hæmorrhage from an intercostal or an internal mammary artery, even enlarging the flesh wound for that purpose; for death has occurred too often from such hæmorrhage, which may perfectly well be controlled.

ETIOLOGY.—The cause of the great loss of blood is in all cases the same. While clotting is retarded or entirely prevented by the incessant movements of the chest and the organs within it, the blood is actually sucked from the vessel by the aspiration of the intrathoracic tension. The effect of this aspiration is of no great importance when the bleeding is into the pericardium or the mediastinum; but it plays an important rôle in pleural effusions, the tension of the normal lung and the size of the pleural cavity being such that the effusion of blood within it may fill half the thorax before the tension is equalized, and having gone thus far it is liable to go still farther and compress the heart and the other lung.

COMPLICATIONS.—Infection of the blood-clot is the complication most to be feared.

PROGNOSIS.—Small effusions of blood become encysted and are gradually absorbed, leaving behind them an area of pleura (or pericardium) obliterated by adhesive inflammation. Infection is infrequent. Not so, however, with the more considerable effusions. For these the danger of infection is paramount. It threatens from all sides; from the thoracic wound, from the bronchi (though the smaller bronchi are germ-free), from any inflamed areas in the lung (and inflammation of a lacerated lung is common), possibly from the blood—and the bacteria, once introduced, demand no better culture-

medium; hence an empyema of sudden onset (see below). But infection may be averted. Then the blood is slowly absorbed as such. Clotting seems not to occur in the pleura of man.

TREATMENT.—The two therapeutic indications are to stop the bleeding and to prevent infection. The treatment of cardiac hæmorrhage has already been described (see Section II), and the necessity of identifying and checking parietal hæmorrhage has been insisted upon. There remains hæmorrhage from the great vessels and from the lung. For the former nothing can be done beyond keeping the patient absolutely quiet, using morphine liberally to that end, and possibly by the use of gelatin in 1-per-cent. solution hypodermically or in the rectum. For hæmorrhage from the lung the same expectant course is probably the best, though venturesome surgeons would have us cut down upon and pack the visceral wound. To perform this operation through an extensive wound in the side is all very well; but to make the wound is asking too much of the patient's strength. If left to itself the lung will continue to bleed until it has completely retracted, unless there are adhesions, and the pleura is full of blood. The tension of the blood in the pleura will then tend to compress the lung, and thus to favor clotting, aided by the syncope into which the patient has fallen. To hasten this syncope by venesection, thereby drawing the blood of a patient who is already bleeding dangerously, is a quaint custom approved by certain English writers. It is safer to wait, though perhaps "splinting" the lung by the injection of air into the pleura might occasionally be beneficial (see below).

When the wound of the lung is giving only slight hæmorrhage, the external



wound should be closed with gauze and the physical signs of bleeding should be watched for. When the hæmorrhage is more marked, the chest is to be opened, a small drainage-tube inserted, and the admission of air regulated according to the difficulty of respiration in the patient. When the hæmorrhage is large and its symptoms alarming, the chest should be opened and a large drainage-tube inserted so as to form a rapid and complete pneumothorax, and at the same time, when necessary, salt solution should be injected into a vein. When this does not control the hæmorrhage, one or more ribs are to be resected and the bleeding radically dealt with. In severe hæmorrhage from a lung, the first object of treatment should be to get pressure on that lung. By opening the chest, air will do this as well as blood in the pleura; it will do it instantly instead of waiting until a sufficient amount of blood has been poured out; it will save to the patient the amount of blood necessary to exert this mechanical pressure; it will permit the vessels to close by clots; and the remote benefits are that it eliminates the dangers of a pyothorax or of universal adhesions of the pleura. The danger from engorgement of the right side of the heart must be slight where the patient has lost much blood. Because it is a great danger in a full-blooded dog is no reason why it should be so in an exsanguined man, for the conditions are different and the cases not parallel. These are personal views, and are not indorsed by the majority of surgeons, but they are the result of experience, and seem logical and correct. R. G. le Conte (Phila. Med. Jour., Apr. 14, 1900).

The second point, the prevention of infection, is readily attended to. The external wound must be thoroughly irrigated with boiled water, normal salt solution, or even unboiled, clean water, if nothing else is to be had, and sutured tightly in layers, if small; in any case covered with an aseptic dressing. No strong antiseptics may be allowed about the wound, lest they leak into the pleura and there prove irritating.

As the case progresses two indications for drawing off the fluid from the chest may arise,—a progressive rise of temperature, namely, and increasing dyspnoea,—the one indicating infection, the other pressure. Paracentesis, the original wound being left undisturbed, is the best way to meet either indication. If the quantity of fluid is large it should be drawn off, a pint at a time, at several sittings. Moreover the operation should be deferred as much as possible, for within the first eight or ten days there is danger of secondary hæmorrhage if the lung is relieved of the pressure upon it. When the fluid withdrawn from the pleura contains bacteria no more than temporary relief from infection may be expected, and as soon as the temperature begins to ascend again permanent drainage must be established either by reopening the old wound or making a new one (see EMPYEMA). But when the fluid is aseptic and the fever continues in spite of paracentesis the inflammation is presumably confined to the lung. Yet it must not be forgotten that empyema may occur even after the pleura has been emptied.

If at the end of twenty days there is still fluid in the pleural cavity paracentesis should be performed.

### Pneumothorax.

SYMPTOMS.—The symptoms are quite the same whether the pneumothorax is traumatic or "spontaneous": *i.e.*, caused by the rupture of a tubercular cavity into the pleura. There is a sudden, sharp pain in the chest, followed by collapse, more or less severe. Even though the shock be slight, the respiration and pulse are irregular and feeble. The affected side moves little or not at all with respiration. The heart is displaced toward the sound side. Vocal fremitus is diminished or absent, and the per-

cussion-note usually tympanitic or amphoric. The voice and breathing are cavernous, amphoric, or absent. If the external wound is patent there is "traumatopnœa": *i.e.*, breathing through the wound.

COMPLICATIONS.—Simple pneumothorax is exceedingly rare. There is usually serum, pus, or blood in the pleura as well as the fluid. In traumatic cases the condition is practically always one of hæmopneumothorax. The signs of hæmothorax may be obtained in the lower part of the pleura, the signs of pneumothorax above, and such special signs as succussion and metallic tinkle between the two (less clearly in hæmopneumothorax than in hydropneumothorax).

Subcutaneous emphysema is rather an associated condition than a complication.

PATHOLOGY.—Pneumothorax, like hydrothorax, is produced by the elasticity of the lung, which tends to retract upon itself toward its hilum as the air rushes into the pleura. In traumatic cases the pleura is usually free from adhesions and the pneumothorax a complete one, the empty lung being surrounded on all sides by air. The loss of the use of one lung and the upset in the equilibrium of thoracic pressure accounts for the marked disturbance of pulse and breathing.

If the opening into the pleura, whether pulmonary or parietal, heals, the lung expands as the air in the pleural cavity is absorbed. If the opening does not heal, the lung expands more slowly by a species of capillary adhesion to the parietal pleura, aided by the varying intrapulmonary pressure of respiration.

PROGNOSIS.—An uncomplicated pneumothorax usually progresses toward re-

covery without accident. Death may, however, occur from the initial shock or from the associated hæmothorax, and the favorable progress may be interrupted by the occurrence of subcutaneous emphysema or dyspnœa, indicative of pressure. Suppuration is rare.

TREATMENT.—Pneumothorax usually requires no special treatment. To relieve pressure or to prevent progressive emphysema paracentesis or drainage may be resorted to.

In pneumothorax the importance of respiratory quietude and the advantage of removing the gas under the same circumstances as one would a liquid effusion are insisted upon. Foxwell (*Brit. Med. Jour.*, Apr. 25, '96).

The best treatment of pneumothorax is by means of a tube or cannula with a valve opening only from within outward. By this means air issues only during expiration, and none enters the pleural cavity during inspiration; hence the air is gradually removed. This method of treating pneumothorax is not only safer than thoracentesis, but more efficacious. D'Alessandro (*Gaz. degli Osp. e delle Clin.*, Feb. 7, '97).

Thirteen cases of empyema and pneumothorax treated by permanent drainage. Five cases were cured, 6 died, and 2, the latter tuberculous, improved, but subsequently showed amyloid degeneration. The appearance of fœtid pus requires immediate thoracotomy. Permanent drainage is most valuable in recent cases, though it is often successful in the latter forms. K. Pitchler (*Deut. Arch. f. klin. Med.*, Dec. 22, '97).

**Subcutaneous Emphysema.**—Subcutaneous emphysema appears as an ill-defined œdematous swelling which pits under pressure, imparting to the finger a fine crackling sensation.

After rupture of the lung it rarely appears unless there is pneumothorax. The emphysema first appears at the root of the neck about the trachea and great vessels, reaching there along the bronchi, trachea, and vessels from the pleura.



It also infiltrates the tissues about any wound in the parietal pleura.

After wounds of the lung there is often an infiltration of air about the external wound, and this is especially liable to occur if the wound is small or roughly sutured so that the air may, by the variations of intrathoracic pressure, be forced into the deeper tissues, but not through the skin.

Subcutaneous emphysema is rarely a matter of any moment. It is usually slight in extent and quickly absorbed. It rarely ends in suppuration. But if the laceration in the lung acts in a valvular manner, pumping air into the lung with each inspiration and allowing none to escape with expiration, the emphysema may spread over all the thorax, even over the whole body, in which case the danger is from suffocation. The treatment is multiple incisions. At the same time the intrathoracic pressure must be relieved by paracentesis or drainage.

**HERNIA OF THE LUNG.** — Hernia of the lung (pneumocoele) occurs either through a wound in the thorax or in a yielding scar.

When it occurs in a wound, the laceration of the thorax is usually extensive and the lung unharmed. In the fluttering, irregular motions of the lung, its edge is protruded through the wound and then caught. Unless it slips back or is replaced it soon becomes oedematous and subsequently hardened, perhaps gangrenous.

The subcutaneous form of hernia is apparently always reducible.

**TREATMENT.** — When the hernia is through a wound its reduction must first be attempted. If this fail, or if the lung become gangrenous, it must be cut away with the thermocautery or allowed to slough away.

The other variety may be reduced and held in place by a pad or a broad belt.

**IV. Foreign Bodies in the Chest.** — Foreign bodies in the heart and pericardium have already received mention.

The foreign bodies in the chest produce no very characteristic symptoms. Their presence is usually suspected from the history, a history of inhaling some object (see **TRACHEA, FOREIGN BODIES IN**), ulceration from the œsophagus, or a wound of the chest. The last class alone concerns us. These foreign bodies — bullets, fragments of bone, splinters of wood, shreds of clothing — are often either unsuspected or inaccessible. If they can be removed from the wound *without probing* they had best be extracted at once. If left *in situ*, whether in the chest-wall, the mediastinum, the lung, or the pleura, they may, if clean, become capsulated and never be heard from, though more frequently they become infected and set up suppurative or gangrenous inflammation, such as empyema or abscess, or gangrene of the lung. When such complications occur after a wound of the chest, the possibility that they are caused by a foreign body may often only be excluded by the use of the x-rays. The *treatment* is extraction of the object by thoracotomy or pneumotomy, and subsequent drainage.

#### **V. Secondary Complications.**

**MURAL SUPPURATION.** — The various forms of superficial thoracic suppuration are more distinctive in their nomenclature than in anything else. The “diffuse phlegmon of the thorax” is a low-grade infection occasionally seen in the cachectic or moribund. “Subpleural abscess” (peripleuritis) appears as a deep-seated abscess between or beneath the ribs. It simulates sacculated empyema. Its etiology is obscure. Subpectoral and axillary abscesses are common. They

require prompt incision. The focus of suppuration may be deeply seated.

**NECROSIS.**—Necrosis of the ribs and sternum is rare, unless the fragment of bone is entirely separated from its periosteum and the rest of the bone. Extraction of dead bone is simple.

**PLEURISY AND EMPYEMA.**—Inflammation of the pleura is one of the commonest among the secondary effects of trauma to the thorax. Dry pleurisy or pleurisy with effusion follows nearly all severe contusions. The effusion provoked by wounds or by hæmothorax is unimportant, and the ultimate adhesions have no peculiar significance.

Traumatic empyema usually follows hæmothorax (which see). Though the onset is acute, the febrile stage may pass over, though the pus remains in the chest, causing some dyspnœa and a chronic toxæmia.

In the *treatment* of traumatic empyema prophylaxis by the removal of hæmothorax as soon as the wound in the lung is healed is of prime importance. Beyond this the treatment is that of any other form of empyema (see EMPYEMA).

**BRONCHITIS AND PNEUMONIA.**—Bronchitis is almost as frequent a complication of injury to the lung as pleurisy. It appears early, and may run into broncho-pneumonia or œdema: two extremely grave complications. Lobar pneumonia following traumatism is a clinical curiosity (see BRONCHITIS and PNEUMONIA).

**GANGRENE OF THE LUNG, ETC.**—Gangrene of the lung may occur in a portion of the lung cut off from its blood-supply, but it is oftener an infective process about a foreign body (see PULMONARY GANGRENE). Abscess of the lung is also usually caused by a foreign body (see PULMONARY ABSCESS). Œdema of the lung and hypostatic con-

gestion are terminal phases, related more directly to the weakness of the patient than to the injury.

**PERICARDITIS, ENDOCARDITIS, AND MEDIASTINAL ABSCESS.**—These subjects have been treated elsewhere.

## VI. Operations upon the Thorax.

**PARACENTESIS (THORACENTESIS; TAPPING, OR ASPIRATION OF, THE CHEST).**—This operation consists in puncture of the pleura or a cavity in the lung and aspiration of its contents.

Paracentesis may be used as a diagnostic measure to determine the presence or quality of fluid in the pleura or lung, or as a therapeutic agent. The therapeutic indications are:—

1. Pleurisy with effusion, as soon as the fluid has reached the angle of the scapula.

2. Hæmothorax, as soon as the danger of secondary hæmorrhage has passed.

3. Empyema. Paracentesis confirms the diagnosis, but is rarely curative, even in children.

*The Operation* (see EMPYEMA, TREATMENT).

**INCISION AND DRAINAGE (THORACOTOMY).**—This is a more formidable operation than paracentesis, and requires the preparations and asepsis usual in a major operation. The operation is indicated for pleurisy with effusion when repeated tapplings have failed to cure, and in empyema almost always.

The following rules may be borne in mind:—

1. Local is safer than general anæsthesia.

2. In selecting the site of incision little stress need be laid on “dependent” points which do not remain dependent in a patient tossing about in bed.

3. Resection of a rib is good routine practice, though children usually do as well without it.



4. Any sudden cyanosis or attack of dyspnœa occurring *before* the pleura has been incised is an indication for immediate incision to relieve tension. If this fails, or the attack occurs *after* the pleura has been incised, roll the patient over, bringing his normal lung uppermost.

[I once nearly lost a case who (having been given ether) was placed in bed after operation lying on his sound side. Respiration grew rapidly feebler; but when apparently at his last gasp he was turned over and immediately rallied. EDWARD L. KEYES, JR.]

5. Never irrigate the pleural cavity at the time of operation except in putrid or gangrenous cases, nor after operation unless the patient is losing ground.

**Thoracoplasty.**—See EMPYEMA.

**POSTERIOR THORACOTOMY.**—The purpose of this operation is the removal of tumors from the posterior mediastinum, or the extraction of foreign bodies lodged in the bronchi or the œsophagus above the ninth rib. The operation has been performed only a few times, usually for obstruction of the right bronchus (opposite the angle of the fifth rib, on a level with the tip of the spine of the fourth dorsal vertebra). A musculo-cutaneous flap covering three ribs is turned back toward the spine. A segment of the central rib is resected with a chain-saw, great care being taken not to injure the pleura. The two adjacent arteries are then tied, and the upper and lower ribs resected and turned back with the soft parts. The pleura, thus exposed, is pulled away. The œsophagus is then recognized by a bougie inserted into it, the bronchus by its incomplete rings of cartilage. An electric head-light enables the operator to see the bottom of the deep hole. The foreign body or tumor is seized and removed, drainage is inserted, and the wound dressed aseptically.

The operation is rarely indicated and still more rarely successful.

**Pneumotomy.**—Paracentesis of the lung for the purpose of aspirating pus or of injecting antiseptics is to be condemned. Paracentesis for diagnosis, but incision always for treatment.

For hydatid cysts and localized gangrene or abscess, especially if caused by foreign bodies, the operation is clearly indicated as the only probable means of relief from a condition always serious and usually fatal. The operation has also been performed for the drainage of tubercular and bronchiectatic cavities. In the latter class it has been fairly successful when the single suppurating cavity constituted practically the whole disease; but in tuberculosis the wide distribution of the lesions, as well as the unfavorable reaction of the disease to stimulation, forbid any operative interference.

**THE OPERATION.**—The seat of disease having been determined by the physical signs and aspiration, the superficial tissues are divided and one or more ribs resected, great care being taken to avoid injuring the pleura until it has been exposed. If adhesions are present the knife is discarded and the pleura and lung incised with the actual cautery heated to a dull-red glow. The seat of disease is thus freely laid open and the patient rolled over to encourage outflow of its contents. Drainage by gauze and tubes is established and hæmorrhage checked by pressure.

In case the pleural adhesions are absent the operation is much more difficult and the prospect poor. Not only may the sudden influx of air carry off the patient in shock, but incision and drainage of the fluttering lung is extremely difficult. Suturing the lung to the chest-wall as a preliminary to incision

of the pleura is no simple matter, and does not prevent partial pneumothorax.

Irrigation of a cavity in the lung is liable to drown the patient.

**Pneumectomy.**—Rabbits have survived complete extirpation of a lung. Man has not. The excision of tumors and tubercular foci has been practiced along the same lines as pneumectomy. But, to dismiss the subject briefly, tumors are either benign or malignant. If benign they require no interference; if malignant they cannot be entirely removed. As for tuberculosis, Koenig says: "To perform such an operation the surgeon must ignore absolutely all his knowledge of pathology" (Peyrot).

**Inflation of the Pleura.**—Inflation of the pleura with nitrogen-gas to "splint" the tuberculous lung has been recommended as a cure by Dr. Murphy, of Chicago. The technique is that of paracentesis, *mutatis mutandis*. Nitrogen-gas is used, since it remains in the chest unabsorbed for weeks, while other gases are absorbed in a few days.

[I learn from Dr. J. Edward Stubbart that he has been very successful in checking severe hæmoptysis by inflation of the pleura. EDWARD L. KEYES, JR.]

**Paracentesis Pericardii.**—Puncture of the pericardium is usually performed in the fifth left intercostal space two inches from the border of the sternum, in order to avoid the internal mammary artery. The preparations are the same as for thoracentesis; but the needle is only plunged into the muscle, and then introduced slowly until the pericardium is reached. While the fluid flows away a finger is kept on the pulse, and the tapping interrupted or stopped if the heart's action becomes weak or irregular. Aspiration should not be employed.

**INDICATIONS.**—Interference with the heart's action by serous pericarditis calls for paracentesis. Hæmopericardium and

pyopericardium demand pericardotomy (see PERICARDIUM).

**Pericardotomy.**—The incision is made in the fifth left space, and part of the rib resected. The internal mammary artery must be respected. Irrigation should never be used.

**Puncture of the Heart (PARACENTESIS AURICULI).**—This operation has been performed for the relief of congestion of the right heart. It does not commend itself.

Puncture and injection of stimulants into the wall of the left ventricle is reputed to have revived the heart after it had apparently ceased beating in alcoholics. In such a case there is little to be said against it.

**Suture of the Heart.**—The prime requisites for success in this operation are speed and boldness. As soon as it is determined that without operation the patient will die, no further time should be wasted, even over asepsis. Operate at once or not at all.

List of 11 instances of suture of cardiac wounds collected from different sources. Death resulted in 8, and the remaining 3 patients recovered. Death was due in 2 cases to great loss of blood, and in 4 cases decided symptoms of infection were present. Conclusions as to technique: The best flap for abscess is a thoracic trap-door with the hinge outward. It is best not to open the pericardium across the pleura, but to carefully push this aside laterally. Interrupted sutures are, as a rule, best for the cardiac wound itself. In the majority of cases a drain is not needed for either the pericardium or the pleura. F. Terrier and E. Raymond (*Revue de Chir.*, Oct., 1900).

As the right ventricle passes under the sternum at each systole, the best incision is Rydygier's or some modification of it—across the sternum and an inch beyond, just above the third rib. From the (left) end of this incision an oblique cut



crosses the third, fourth, fifth, and sixth ribs downward and outward. Sternum and ribs are divided, the flap turned back, the internal mammary arteries secured, and the pericardium laid open from top to bottom and held open with clamps. The wound in the heart is sutured with a small needle and fine silk. The sutures are passed and tied during systole and must not pierce the endocardium. If the heart falter or stop, let the operator speed the more. Finally the pericardium is delicately emptied of clots, sutured roughly, and the flap replaced. In the meanwhile stimulation and infusion are plied.

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New York.

**THYMOL.**—Thymol, U. S. P. (Thymecamphor; thymic acid; methyl-normal-propyl-phenol), is a phenol from the volatile oil of *Thymus vulgaris*, L., a garden-herb indigenous to Europe, but cultivated elsewhere. Thymol occurs in colorless, translucent crystals, having a thyme-like odor, and a pungent, somewhat caustic taste. It is soluble in alcohol, ether, chloroform, carbon disulphide, glacial acetic acid, and oils, and in 1200 parts of water.

The oil of thyme (oleum thymi, U. S. P.), often misnamed oil of origanum, is a volatile oil which is soluble in alcohol, ether, chloroform, and in carbon disulphide, and possesses antiseptic and stimulating properties; it is principally used externally.

**Preparations and Doses.**—Oleum thymi (U. S. P.), 3 to 15 minims.

Thymol (U. S. P.), 1 to 10 grains.

**Physiological Action.**—Thymol paralyzes the terminal sensory nerves of the skin and mucous membranes, but is a

local irritant. When given internally in doses of 20 to 30 grains, *per diem*, it causes a sensation of epigastric heat, associated sometimes with nausea and vomiting, but more generally with abundant diaphoresis, tinnitus aurium, deafness, a feeling of constriction in the forehead, a lowering of the temperature, and frequently diarrhœa. The urine is increased in quantity and becomes olive- or dark-green in color, yellowish brown by transmitted light, and free from albumin; on the addition of the tincture of the chloride of iron it becomes cloudy and grayish white in color. Violent delirium has occurred several times, marked collapse, and in one case (typhoid fever) unconsciousness with alarming collapse. The continuous use of thymol in small doses appears to interfere in some way with nutrition, so that emaciation results. Küssner has found that thymol has the power of dissolving the red blood-corpuscles. Thymol is excreted by the kidneys partly as thymol, partly as thymo-hydrochinon united with sulphuric acid, and partly as chromogen, which is probably an oxidation product of thymol, and partly as some acid of unknown constitution (F. Blum, Deut. med. Woch., xvii, '91).

Thymol lowers arterial tension and reflex action, reduces the temperature, and may cause fatal coma. The nerve-centres of the cord are paralyzed by large doses.

**Poisoning by Thymol.**—The poisonous properties of thymol have been demonstrated by the experiments of B. Küssner, who found that when given to dogs and rabbits by the stomach the poison acts very slowly and feebly, by reason of its slow absorption, but that when injected into the circulation it produces death by respiratory paralysis. Coma is developed some time before death, and

the blood-pressure, which at first was maintained, now falls steadily.

The treatment of poisoning by thymol consists in the use of emetics or the stomach-siphon to evacuate the stomach and the employment of respiratory stimulants.

**Therapeutics.**—Thymol has been used as an antiseptic, anthelmintic, and antipyretic. The last use is condemned by H. C. Wood and others on account of its poisonous properties. Bälz concludes that thymol is much less certain and more dangerous as an antipyretic than is salicylic acid.

Martime commends this drug as an antiseptic sedative in typhoid fever, intestinal catarrh, etc., 30 grains being administered during the twenty-four hours. This use of thymol is indorsed by F. P. Henry, of Philadelphia. Gros commends it internally in diphtheria. Küssner has used thymol (3 to 5 minims of a 1-per-cent. solution three times a day) with advantage in diabetes, vesical catarrh, and in infantile diarrhœa, and has found that inhalations (1 to 1000) diminish the fever and expectoration in phthisis.

Campi has used thymol with success as a tæniacide. Five to 6 drachms of castor-oil are given at bed-time, and the next morning, beginning early, 10 grains of thymol are given every fifteen minutes for 12 doses, and 20 minutes after the last dose of thymol another dose of castor-oil. Sonsino, of Pisa, has had no results from it as a tæniacide, but has found it useful in cases of ascarides and especially *Oxyuris vermicularis*, in which last case he administered it by enema.

Externally thymol has been used as an antiseptic dressing. It has been found to be an excellent application in eczema, psoriasis, pityriasis, and ringworm. A 2-per-cent. ointment is of service in acne and alopecia circumscripta. The addi-

tion of a small portion of alcohol facilitates the preparation of a 1 to 1000 watery solution, which is sufficiently strong and sometimes needs further dilution.

In leucorrhœa a thymol solution has been found useful as an injection (1-3000 to 1-1000).

In catarrh of the upper air-passages C. C. Rice, of New York, recommends inhalations of the following:—

℞ Menthol,  
Thymol,  
Carbolic acid, of each, 5 grains.  
Oil of eucalyptus, 2 ounces.  
Oil of pine-needles (*pinus Sylvestris*), 3 ounces.—M.

A teaspoonful is added to boiling water and the steam inhaled, or 20 to 30 drops are placed upon a sponge or piece of cotton and held to the nose.

For use as a mouth-wash, a solution (1 per cent.) of thymol in glycerin may be employed. Thymol-soap (2 per cent.) is recommended as an antiseptic cleanser.

An infusion of thyme is of service in whooping-cough; it alleviates the spasms, and is said to shorten the duration of the disease.

Oil of thyme may be employed as an internal remedy in cases of collapse, in bronchial affections, catarrh, and colic; externally it is useful in pruritus, weeping forms of eczema (to lessen the discharge), and as a pleasant, fragrant antiseptic for the bath.

THYMACETIN is a derivative of thymol, and is closely allied to phenacetin. It occurs as a white, crystalline powder, soluble in alcohol and ether and very slightly soluble in water. It has the same relation to thymol that phenacetin has to phenol. Solly recommends it as a valuable analgesic in headache and neuralgia, and as an hypnotic in insomnia



and delirium. The dose is from 5 to 15 grains, best given in capsule.

### THYROID GLAND, DISEASES OF.

**Thyroiditis.**—Inflammation of the thyroid gland either when organically in its normal state or when goitrous.

**SYMPTOMS.**—Inflammation of the thyroid is attended, as in the case of other tissues, by local pain and swelling, sometimes followed by suppuration in one or both lobes. The febrile symptoms may be quite marked and attended by severe cephalalgia and vertigo. The enlarged gland compresses the neighboring vessels, producing cyanosis, and, as a result of the secondary vascular engorgement, epistaxis. When an abscess is formed, it usually tends to break through the adjacent soft tissues, but not always through the skin. The trachea and œsophagus are therefore the seat of the purulent flow when rupture occurs. Metastatic abscess may also appear in the cervical cellular tissue. When spontaneous rupture occurs through the skin, or when the abscess is surgically evacuated the inflammatory process recedes. When, however, it is left to itself, the purulent infiltration of surrounding parts may give rise to serious complications.

**ETIOLOGY.**—Thyroiditis occasionally occurs as an idiopathic disease, but, as a rule, it is due to the invasion into the glandular tissues of infectious germs during febrile disorders, especially typhoid fever and variola. Arthritism and the malarial toxæmia are thought to predispose to it, while uterine, menstrual, and climacteric disorders tend to cause congestion which, often repeated, may give rise to active inflammation.

**TREATMENT.**—Besides the antiphlogistic measures adopted from the start, of which lead-water and laudanum, ice-

bags, or compresses, etc., are probably the best, the case should be carefully watched lest symptoms of pressure upon important vessels imperil the patient's life. Low tracheotomy (without general anæsthesia) is sometimes suddenly necessary. When an abscess is formed, it should be evacuated as soon as fluctuation is detected.

**Thyroid Fever.**—This is a febrile disorder which occurs in cases of partial thyroidectomy. Bérard, who observed it in 60 per cent. of the latter, and in 70 per cent. of cases of exothyropexy, states that the pulse and respiration are not accelerated in proportion to the rise of temperature. The patient complains of flashes of heat, sweats abundantly, and sometimes has tremor and shows considerable excitement; there may be patches of cutaneous hyperæmia due to vasodilatation; the tongue remains moist and rosy, the digestive functions are unaffected save at the period of decline, when diarrhœa is not uncommon; the heart-sounds are regular and sharp, and nothing abnormal is detected on auscultation of the lungs. If the wound is uncovered at the end of two or three days, the deep parts of the dressing, around the drainage-tubes, are found to be moistened with a clear, odorless serum, and the skin in the neighborhood of the sutures is neither inflamed, hot, nor œdematous. Usually the more abundant is the serous flow, the higher the temperature.

**Tumors of the Thyroid.**—Roger Williams, in an analysis of the primary tumors under treatment at four large metropolitan hospitals during a period of from ten to fifteen years, found that of 7294 cancers only 7 originated in the thyroid, and of 1266 sarcomas only 1 started in this situation. A careful search in literature by Tippy and

Lanier enabled them to find records of only 16 cases of sarcoma of the thyroid. Of these 4 were doubtful. It appears generally to occur in patients well above forty years of age. Usually the growth is spindle-celled, but may be round-celled or mixed. Not one of the cases in the tables of these writers survived the operation, undertaken usually for the relief of dyspnoea, for more than a few days. (Firth, *Lancet*, Aug. 26, '99.)

(See also GOITRE, EXOPHTHALMIC GOITRE, INFANTILE MYXŒDEMA, and MYXŒDEMA.)

### TONGUE, DISEASES OF.

**Tongue-tie, or Ankyloglossia.**—The condition known as tongue-tie is due to an abnormally short frænum linguæ. To this condition was formerly attributed many of the disorders of infancy, and section of the frænum was frequently resorted to. Although it is frequently restricted in length, it is only when it is bound down so as to cause it to be held behind the incisors that a short frænum can prevent suckling or interfere with articulation. Undue elongation of the frænum may produce similar symptoms, especially when its upper insertion is unusually near the tip.

**TREATMENT.**—Although section of the frænum is an operation presenting no difficulty, it may become dangerous if the presence of the ranine arteries is not borne in mind, fatal hæmorrhage having occurred. The tissues should therefore be carefully examined and the portion cut should be isolated from any vessel that may be encountered. Blunt-pointed scissors are usually employed, after anæsthetizing the parts with a 10-per-cent. solution of cocaine, applied with a camel's-hair pencil. The mouth should be kept scrupulously clean.

Section of the frænum should be extremely limited in its application; it is warranted, for example, when there exists an ankyloglossia, congenital or acquired, immobilizing the tongue more or less in a part of the mouth. This may be total or partial. When the frænum is excessively long, reaching sometimes to the point of the tongue and impeding its movements, simple section is not sufficient; excision must be resorted to. It is wrong to think the operation is always indispensable if the child nurses badly. A few exercises in suction on the finger may correct this defect without any operative intervention. In all cases excision of the frænum is absolutely useless for correcting faults of pronunciation. These are amenable only to a methodical, natural, and rational education of the organs of speech, the duration of which need not exceed three weeks. Chervin (*Revue Inter. de Méd. et de Chir.*, Sept. 10, '94).

**Lingual Papillitis.**—This is a form of glossitis often met with in gastric disorders, localized in the papillæ of the tongue, and described by Cotard. Its only symptom is a burning or lancinating pain on the anterior two-thirds of the tongue, with greater intensity on its tip and borders. The pain, often recurring at intervals in the form of neuralgic attacks, is aggravated by the ingestion of food,—solid or liquid, with the exception of milk. No other trouble, either of general and special sensibility or of the salivary secretion, is observable. Examination with the naked eye does not reveal any remarkable alteration, but examination with the magnifying-glass shows, in several places, and chiefly on the borders and tip of the tongue, some little red points, ulcerated and very painful when touched, whose number is greater in proportion as the pain is more violent. The seat of this lesion is evidently in the nervous terminations in the lingual mucous membrane, or, more exactly, in filiform papillæ.



The best treatment is galvanic cauterization (with the aid of the magnifying-glass) of the ulcerated points, a few points being touched at each sitting (Duplaix).

**Glossitis.**—Inflammation of the tongue is usually due to traumatism. It may be caused by hardly-perceptible injuries inflicted during mastication, or to more evident factors: carious teeth, scalds, bites, incised or punctured wounds, laceration, etc. It is quite probable that inflammation of the tongue never occurs without the introduction in its parenchyma of some pyogenic organism.

**SYMPTOMS.**—The first symptom is tumefaction of the organ, which is sometimes so great as to cause it to protrude from the mouth. Severe pain is usually present and deglutition is seriously impeded through the marked sensitiveness of the organ. When the swelling involves the lymphatic elements in the posterior portion of the tongue, dyspnoea may appear, owing to the pressure upon the epiglottis. Stomatitis is usually present and ptyalism is more or less marked. The breath is usually foetid, a feature due to a thick, yellowish coating on the lingual surface, which may also present striæ of ulceration. There is usually considerable fever. The symptoms generally become aggravated up to the third or fourth day, when there is a lull, followed by gradual improvement. Occasionally an abscess forms deep in the organ and occasionally close to the periphery. In the latter case it is quickly relieved by incision, which soon reduces the glossitis. Gangrene sometimes occurs. In rare cases one side only is involved in the inflammatory process.

**TREATMENT.**—The tendency of the patient to expose his tongue to the air tends to increase the trouble by allowing desiccation of the surface. While he

should be fully permitted to continue this practice, because it affords relief in various ways, the tongue should be kept moist and clean, by means of a mucilaginous solution containing 10 grains of boric acid to the ounce. This can best be done by the patient himself with a cotton swab. When he can close his mouth small pieces of cracked ice are grateful, and the solution mentioned should be used as a mouth-wash several times an hour. When there is great infiltration, scarifications with a thin knife (under antiseptic precautions) afford marked relief if a couple of ounces at least of blood are drawn. Severe pain may be counteracted by painting the organ once in awhile with a 4-per-cent. solution of cocaine. When the ingestion of food becomes difficult a catheter introduced on the side of the tongue into the pyriform sinus—*i.e.*, alongside the larynx—can adequately serve for the administration of liquid food. This manœuvre is given in detail under ŒSOPHAGUS (volume v), in the treatment of cancer of that canal. Rectal alimentation is sometimes necessary. Tracheotomy is occasionally demanded to avoid asphyxia. Saline purges early in the case tend to shorten the duration of the lingual inflammation.

**Chronic Glossitis.**—This condition, in many cases, is attributed to syphilis, when in truth it is but the result of tobacco irritation, or, as shown by Brocq, to gastric affections in rheumatic subjects. Strong alcoholic drinks occasionally represent the primary source.

**SYMPTOMS.**—The tongue is red and sensitive, especially near the edges, and oval grayish patches resembling those of syphilis replace papillæ or epithelial cells, which have yielded to the superficial ulcerative process. The resemblance to syphilis is further supported

by deep furrows, which tend to separate the tongue into island-like, lobulated surfaces. A foul breath is often present, especially when the condition occurs in drunkards. The history of the case and the results of treatment alone facilitate the recognition of the true disorder present.

**TREATMENT.**—Correction of dietetic errors are of prime importance. If syphilis is suspected, a course of iodide of potassium with the copious use of water simultaneously will do no harm if no luetic trouble is present. Applications to the furrows of a nitrate-of-silver solution, 20 grains to the ounce, with a camel's-hair pencil (never the solid stick) soon improves them. The oral cavity should be kept scrupulously clean, and washed out three times daily with a saturated solution (one drachm to the pint) of chlorate of potassium.

The use of a 15-per-cent. solution of silver nitrate, or a 5-per-cent. solution of chromic acid, simultaneously with the galvanic current, recommended. The method of procedure is as follows: After painting the affected tongue with either of the two solutions, the patient is told to hold the wet positive sponge electrode in one hand while the negative metal electrode is rubbed over the painted diseased areas for from ten to fifteen minutes. This produces an excess of saliva, which is caught by a large piece of absorbent cotton held to the mouth. M. L. Ravitch (*Jour. Amer. Med. Assoc.*, May 31, 1902).

**Leukoplakia.**—This oral disorder is assimilated by various authors to psoriasis, herpes zoster, etc. While it may affect the entire mouth, it is usually most marked on the tongue, and consists of whitish, opaline patches of cicatricial aspect, which tend to disappear spontaneously and to reappear. It gives rise to no distressing symptoms other than slight pain at the seat of the lesions,

which are, in reality, narrow, minute ulcers.

Leukoplakia occupies an important position in diseases of the tongue, since it is thought by many authorities to be a frequent precursor to epitheliomatous cancer of that organ.

Two hundred and forty cases of leukoplakia studied. Lesions believed to be, as a rule, epithelial thickening, resulting from mucous patches. Only two cases were in women, both syphilitic. Four grades of the affection are recognized: 1. Very slight changes at the corner of the mouth, generally unilateral; a dull, dry appearance, with slight epithelial thickening. 2. Appearances more marked, thickening greater, white coloration. Similar small patches on mucous membrane of cheek, lips, and tongue. 3. More extensive patches, with intense white enamel-like appearance, on angle of mouth, in cheeks and lips. The tongue shows everywhere white opaline spots, and often small cracks; thin, minute, painful ulcers, which come and go. 4. Changes most marked in the tongue. The whole upper surface is smooth, shining, enameled in spots, the papillæ gone. In the largest proportion of cases the angle of the mouth, alone or together with some other part, was affected; the tongue alone in nine cases, the lips alone in three. In about 80 per cent. of the cases there was a clear history of syphilis. In many of the other cases there was a strong suspicion of such infection. In four or five cases antisyphilitic treatment either cured or much improved the condition. Of 148 cases questioned as to tobacco-smoking, 47 smoked little or not at all, 101 moderately, and 2 excessively. Syphilis alone occurred in 36 of these cases, smoking alone in 37, syphilis and smoking in 64, and neither in 11. W. Erb (*Münch. med. Woch.*, Oct. 18, '92).

**TREATMENT.**—As a local application for leukoplakia, Rosenberg uses iodide of potassium in a 20-per-cent. solution painted on the affected points. With this treatment leukoplakia has disappeared in a few days, after lasting for



seven years and resisting all usual methods.

The following paste, applied with a swab, is recommended by Leistikow, in leukoplakia:—

R̄ Terræ siliceæ, 24 grains.

Resorcini, 48 grains.

Adipis, 8 grains.—M.

After eight to fourteen days a shriveling is noticed, when the slightly inflamed mucous membrane can be brought to a normal condition by balsam of Peru.

According to Perrin, the only treatment for leukoplakia is the complete extirpation of the spots by surgical means. It is the only way to avoid the final evolution of this disease into true epithelioma. Solid nitrate of silver should never be used.

The patient should be counseled to give up tobacco and alcoholic drinks, to avoid hot food, acids, and condiments. If a bad tooth seems to be the cause of the trouble, it should be extracted or its cavities filled and its edges rendered smooth. If an ill-fitting plate is worn, it should be discarded and a more nearly perfect article be procured. Antiseptic and alkaline mouth-washes are useful. An application consisting of  $\frac{1}{2}$ -per-cent. corrosive sublimate and 1-per-cent. chromic acid solution has been recommended by Schwimmer. The writer has advocated the local use of papain, 1 part being dissolved in 10 parts each of distilled water and glycerin. In a case affecting the upper lip and tongue, H. Niemeyer, by the application of this solution once every day, obtained complete healing of the tongue and decided improvement of the lip in seventeen days. Sherwell claims speedy improvement, after the application two or three times a day, of undiluted mercuric nitrate, protecting the adjacent parts with absorbent cotton and neutralizing with sodium bicarbonate and glycerin. J. V. Shoemaker (New York Med. Jour., Nov. 23, 1901).

**Ulceration of the Tongue.**—The tongue frequently becomes the seat of

ulcers, benign and malignant, and the recognition of their true identity is frequently of unusual importance. Lingual ulcers may be divided into four classes: simple ulcers, generally due to disorders of digestion; those occurring as a manifestation of syphilis; those due to tuberculosis or lupus; and finally those attending cancer.

**SIMPLE ULCER.**—This usually occurs around the edge of the tongue, and its border may be tumefied and raised as is the case in epithelioma. In the neighborhood, however, may often be found a carious tooth, or the lesion may be traced to some other form of traumatism. While there is swelling around the base, it is limited in extent and there is no induration such as characterizes cancer. Upon removal of the cause, or under simple remedial measures (see GLOS-SITIS), it soon disappears.

**SYPHILITIC ULCER.**—Syphilitic ulcers are usually preceded by an induration; in cancer this induration almost always appears after the ulcerative process has begun. The ulcer in syphilis is usually located near the tip; a cancerous ulcer is on the side. There are usually two or more gummata; cancerous ulceration is always single. The tongue is often furrowed and fissured in syphilis; such is never the case in cancer. There is often a history of syphilis, and test treatment of this condition soon establishes the diagnosis.

**TUBERCULOUS ULCER.**—A tuberculous ulcer is single, as in cancer, but there is no induration; though it may, by its color, resemble a gumma, it is often yellow. Examined closely, the bottom of the ulcer may be seen to present minute, yellowish dots, even if the ulcer is grayish white; this is the main habitat of tubercle bacilli, which can often be detected in scrapings. Tubercular ulcers

sometimes heal, leaving a scar; a cancerous ulcer spreads steadily. A tuberculous ulcer usually occurs as an accompaniment of tuberculosis in another region, especially the larynx. Lupus rarely, if ever, attacks the tongue primarily.

**CANCEROUS ULCER.**—The ulcer attending cancer, besides the features already noted, is ragged and everted, progresses irregularly in various directions, and presents an angry-looking appearance. It soon becomes fungous and granular, is covered with an ichorous, foetid liquid, and bleeds upon the least contact: a condition witnessed in no other variety of ulcer. Again, the neighboring glands soon become enlarged: the only condition in which this occurs in lupus, which seldom if ever attacks the tongue primarily. The age of the patient, beyond forty years, at which cancer occurs is seldom, if ever, that after which lupus is observed.

#### **Tumors of the Tongue.**

The relative frequency of tumors of the tongue was well illustrated by statistics based upon 13,824 neoplasms treated in two London hospitals during a prolonged period. An analysis of these cases by Roger Williams showed that out of this number 880, or 6.3 per cent., originated in the tongue. As regards the varieties observed in this organ, 804 out of the total number were epitheliomata (91.3 per cent.), while the remaining forms consisted of sarcomata, papillomata, cystomata, fibromata, adenomata, angiomas, and one myxoma.

#### **Cancer of the Tongue.**

As just stated, the variety invariably met with in the tongue is epithelioma.

**Symptoms.**—The symptoms depend upon the location of the initial lesion. When it begins far back in the mouth, the submaxillary or posterior sublingual

regions become sensitive, and darting pains reaching the ear are complained of. If the region be palpated, lobular, movable, hard swellings may perhaps be felt: glands which are infiltrated. Deglutition soon becomes somewhat impaired, and the tongue is moved with difficulty during articulation. The submaxillary glands have, by this time, probably become fixed and enlarged in size and the disease progresses rapidly. Profuse ptyalism is soon followed by the expectoration of foul pus, often tinged with blood, all evidences that the stage of ulceration has begun. This involves the danger of death from hæmorrhage, owing to the proximity of the growth to large vessels.

When the growth starts anteriorly, the process may be followed with more precision. A small slit or crease, a minute hypertrophied papilla, or a small warty projection may prove to be the primary focus. The crown of this soon becomes ulcerated and covered with thin scabs, which the patient removes as fast as formed, leaving a bleeding surface. Then gradually develops the typical epitheliomatous ulcer with ragged edges, and a hard, broad, infiltrated base and fungous outgrowths filled with foetid pus, which gives the breath a repulsive odor. As the neoplasm spreads, the suffering of the patient gradually becomes more acute, the tongue is immovable, the submaxillary markedly enlarged, and he gradually sinks as a result of starvation and exhaustion, if hæmorrhage does not bring on sudden death. When the growth begins anteriorly, the lymphatics are not involved as early, and the chances for a successful operation are consequently greater.

[The lymphatics from the anterior portion of the tongue, from the lips, and adjoining parts of the mouth pass to the lymph-glands under the lower jaw, in



contact with the submaxillary; thence the current traverses the superficial cervical lying beside the sterno-mastoid; from these, to the deep cervical in contact with the large blood-vessels. Hence, in epithelioma primarily attacking the parts here indicated, we always find these three sets of lymph-glands enlarge successively.

On the other hand, the lymph-current from the root of the tongue and from the pharynx passes mainly to the deep cervical glands; a portion from the surface tissue also to the superficial cervical. Epithelioma, commencing here, accordingly implicates secondarily these two sets, sometimes only the deep. The submaxillary lymph-glands now always escape infection,—that is, until a very late stage,—and those at the edge of the sterno-mastoid may do so. RUDOLPH MATAS, Assoc. Ed., Annual, '93.]

**Etiology.**—Cancer of the tongue is comparatively rare among women, being about 16 per cent. of reported cases. This is, to a certain degree, accounted for by the causative factors, the principal ones of which are: smoking, jagged teeth, the scars of syphilis, alcoholic drinks, the pressure of a pipe-stem on one spot, a traumatism; various disorders of the tongue, especially leukoplakia, etc.; in fact, any condition which tends to cause irritation of any one part of the organ. A condition of the surface of the tongue called "leucoma" by Hutchinson, a form of chronic glossitis, appears as a primary cause in 16 out of 80 cases analyzed by Butlin. The promiscuous application of solid nitrate of silver or any kind of caustic is also thought to be another prolific source.

The age at which epithelioma of the tongue appears corresponds to that of cancer in other parts of the organism, namely: after 45 years. Occasionally, however, it occurs earlier. According to Warrington Howard (*Lancet*, Mar. 2, '95), a larger proportion of the cases found to be under 30 occur in women.

Hereditary predisposition may be traced in many cases.

**Prognosis.**—Left to itself, lingual epithelioma steadily progresses, and death occurs in from eighteen months to two years after the character of the neoplasm has been recognized. In a series of 69 cases treated by Sachs the average time elapsed between the onset of the growth and the time the cases presented themselves for treatment was five months. It is probable, therefore, that two years represent the average duration of life from the start of the initial lesion. The prognosis is also greatly influenced by the thoroughness of the operation performed; the more radical this is, the better are the chances, especially if neighboring glands are involved. An early involvement of the glands is an unfavorable sign, particularly when the cervical glands behind the angle of the jaw are affected. An operation, if performed when the case is not too far advanced, invariably prolongs life even in cases of recurrence. This is especially evident in private cases.

Study of 102 cases of operation for cancer of the tongue in which primary operation was performed. Nearly an equal number was operated upon in hospital and private practice. After getting returns from all but 7 cases, it was found that, besides the fact that the mortality was greater immediately subsequent to the operation in the hospital cases, the number of absolute cures with freedom from return, in some cases for thirteen years, and in all for over three years, was much greater in the private than in the hospital cases. Number of deaths due to operation in hospital group is 9, while only 1 of private patients in whom there was marked involvement lost. Number of such patients alive and free from disease more than three years after operation, or who died from other causes after the extirpation of three years, was 7 in hospital group and 13 in other group, and there are 9 others free

from return after one year, but not over three years, while there are only 2 hospital patients who may prove cures. Percentage of cures in hospital group of cases at best is 16, while private cases is 26, with a chance of its being much greater.

The reason for the difference in results is that the private patients are better educated and come for operation much earlier than do the others, which illustrates great advantage for early operation. Cases which may be claimed as cured show that the disease, in the large majority of them, was situated in the anterior two-thirds of the tongue. But even some of the worst cases may be cured if the disease has not invaded the tonsillar and neighboring regions. Among private patients cured there was not one in whom the glands were removed, while, in the hospital cases, of the 7, 5 had the glands removed at the time of the operation or immediately subsequent to it by a second operation, and in 4 or 5 they were not only enlarged, but proved by microscopical examination to be cavernous. The whole tongue was removed in only 1 of the successful cases. Butlin (Brit. Med. Jour., Feb. 26, '98).

**Treatment.**—According to Butlin, whose results have been, when compared with those of many other operators, most satisfactory, removal of the entire tongue is not essential to a successful operation. With the cancer, he removes three-fourths of an inch of apparently healthy tissue around it in every direction. When the disease is on the border of the tongue, half the tongue to an inch behind the margin of the disease, is excised. In cases in which the disease is near the tip or forepart of the dorsum, the forepart of the tongue is removed. During recent years this surgeon has resorted to the following operation, in which the entire contents of anterior triangle of the neck is removed: A very careful dissection of the triangle is made, so that the connective tissue

and glands are all taken out in one continuous mass. Search is made between the muscles in front for one or two deeper-seated lymphatic glands, and the glands in front of the parotid gland and about the angle of the jaw are taken out with the contents of the triangle. The submental and parotid glands are not so easily and certainly removed *en masse* in this operation as the submaxillary and carotid groups. This is done at a second operation, and not at the time of the excision of the tongue.

Out of 61 operations personally performed for malignant disease of the tongue, none died from the effects of the operation save 1, a male on whom Kocher's method modified was used; he died of asthenia. Of the 61 cases, in 29 the disease returned. Many of these operations were performed, not with a view to cure, but merely to relieve and remove a foul, sloughing, foetid mass, and thus render existence more tolerable. Twenty-two cases were not traced directly, but it was learned indirectly that 5 were healthy three or four years after operation. Seven others had had no return of the disease, to personal knowledge, one to fifteen years after operation, while 3 had no return seven, three, and two months after operation. It is expedient to ligate the external carotid before removing the tongue, tonsils, and part of the palate; but preliminary ligation of the lingual arteries in excision of the tongue, as recommended by Mirault, is not required; there is no hæmorrhage from the ranine arteries to cause alarm; it is good surgery to remove the tongue first and then the diseased glands later, if it is necessary to do the operation in two stages.

Thermocautery-scissors preferred when suitable. The tongue is held by toothed forceps, and just as the ranine arteries are about to be severed the hot blade is allowed to cool a little, in order to allow the arteries to bleed; they are then secured and ligated. Frequent sprays are the best antiseptics. Wheeler (Dublin Jour. Med. Sci., Apr., '97).



New operative method in dealing with cancer of the tongue. Recent anatomical research has demonstrated that the lymphatics of the tongue communicate not only with the glands over the carotid and with those on the surface of the submaxillary gland, but also (1) with a submental gland lying on the mylo-hyoid muscle; (2) a gland in contact with the external jugular at the point of crossing of the omo-hyoid muscle; (3) some small glands in the muscle of the tongue itself near the hyoid bone. The lymphatics of the tongue also communicate very freely with each other. Hence, in operating in cases of lingual cancer the author argues that the lymphatic glands on both sides of the neck should be removed.

The operation is first performed on one side of the neck, and repeated after an interval on the other side. During the operation the lingual and facial arteries are tied and the submaxillary gland removed. At the third and final operation the tongue is removed by Whitehead's operation. Poirier (*Revue de Chir.*, June, 1902).

Walter Whitehead, after an experience obtained in a large number of cases, recommends the following procedure: The patient is placed completely under the influence of the anæsthetic during the first stage of the operation, but afterward only partial insensibility is maintained; the mouth is securely gagged and kept fully open throughout the operation; the head is supported in such a position, that while the best light is secured, the blood tends to gravitate out of the mouth rather than backward into the pharynx; a firm ligature is passed through the tip of the tongue for the purpose of traction. The first step in the operation consists in dividing the reflection of mucous membrane between the tongue and the jaw and the anterior pillars of the fauces. Rapid separation of the anterior portion of the tongue from the floor of the mouth is then made. If possible, the lingual arteries should be secured with Spencer Wells's

forceps prior to division. A ligature is passed through the glosso-epiglottidean fold before finally separating the tongue. A mercurial solution should be applied to the floor of the mouth, and the surface painted with an iodoform styptic varnish.

[In such operations the heat of the mouth tends to promote the development of infectious elements and fermentation, causing fœtor. Puzey, in two cases, was able to thoroughly prevent the latter by hourly painting the whole wound with glycerin and borax. RUDOLPH MATAS, Assoc. Ed., Annual, '96.]

Hæmorrhage is one of the most important dangers encountered during amputation of the tongue and subsequently. Secondary hæmorrhage is especially liable to occur when the wire or galvanocautery *écraseur* is used, at the time the slough becomes separated. Whitehead's operation described above is done with scissors after the lingual artery has been ligated. But if this should give way, the following procedure recommended by Mr. Heath arrests the bleeding: The forefinger passed well down beyond the epiglottis is made to hook forward the hyoid bone and drag it up as far as practicable toward the symphysis menti. The effect of this is to stretch the lingual arteries so as to completely control for a time the flow of blood through them.

Antisepsis of the mouth until healing is complete is an extremely important feature of surgical measures. It should be frequently washed out or painted with a strong solution of borax.

KOCHER'S OPERATION.—Another danger connected with excision of the tongue is septic pneumonia or bronchopneumonia, brought on through infection from the wound. This is prevented to a great degree by Kocher's method of excising the organ, the pharynx being plugged with carbolyzed sponges and

iodoform gauze, after tracheotomy has been performed. The trachea is thus totally disconnected from the wound and no pus can enter it. The patient is fed by the rectum and by the mouth twice a day, when the oral dressing can be safely changed without involving infection for a few minutes. The operation itself is performed as follows: "An incision is made commencing a little below the tip of the ear and extending down the anterior border of the sterno-mastoid muscle to about its middle, then forward to the body of the hyoid bone and along the anterior belly of the digastric muscle to the jaw. The resulting flap is turned up on the cheek and the lingual artery is ligatured as it passes under the hypoglossus muscle. Commencing from behind, all the structures in the submaxillary fossa are removed, viz.: the lymphatic glands, the maxillary, and if necessary, the sublingual glands. The opposite artery is now tied by a separate incision if the whole tongue is to be removed. The mucous membrane along the jaw and the mylohyoid muscle are then divided and the tongue drawn out through the incision and removed with scissors or galvanocautery."

**AFTER-TREATMENT.**—More than ordinary attention must be given to this feature of the operation. We have seen the dangers accruing from the gravitation of pus into the bronchi, septic infection from the wound, etc. Before, during, and after the operation the mouth should be kept as aseptic as possible by means of borax or permanganate-of-potassium solution, 20 grains to the ounce of the former, and 1 grain to the ounce of the latter. After the operation Whitehead washes the parts with a solution of perchloride of mercury, dries it thoroughly, then applies an antiseptic varnish composed of the ingredi-

ents of Friar's balsam, but substituting a saturated solution of iodoform in ether. This he found to be more comfortable to the patient than gauze or lint. Some surgeons prefer to pack the cavity with moist iodoform gauze—made with glycerin and rosin dissolved in alcohol. Mansell-Moullin cuts this into strips, packs the whole cavity with these, laying them flat one upon the other with fresh iodoform between until the wound is filled. The deeper layers adhere to the raw surface, from which they cannot be separated until it has begun to granulate; the superficial ones sodden with saliva may be removed from time to time. At the end of a few days the whole comes away itself, leaving a healing surface beneath.

The patient should at first be fed by the rectum. After three or four days a catheter or soft tube may be introduced into the pyriform sinus on either side of the larynx, and the patient may be fed through it. As soon as the patient is able to sit up, the second or third day, he should, as much as possible, hold his head forward and downward so as to prevent gravitation of the discharges into the pharynx and œsophagus.

**Sarcoma.**—The number of recorded cases of sarcoma of the tongue, according to Georges Marion (*Rev. de Chir.*, Aug., '97), is limited to 24; it may occur at any age, but in one-half of the cases it occurs before the thirtieth year. It is as common in the female as in the male. The tumor may be composed of round or spindle cells or of a mixture of these. It may be seated in the substance of the tongue or be pedunculated. The symptoms are chiefly the result of its situation or volume. They offer nothing characteristic of the neoplasm. The secondary swelling of the glands seems to occur very late. A positive diagnosis of



lingual sarcoma can hardly be obtained except by "test-excision" and careful microscopical examination of the excised pieces. The differential diagnosis between sarcoma and gumma is frequently impossible, even by microscopical examination of excised fragments; in such cases an energetic syphilitic treatment is first indicated. Neither hæmorrhage nor pain are frequent. The enlargement of glands which may accompany the affection is either inflammatory or an evidence of generalization. Although the progress of the disease is rapid, the prognosis is relatively favorable, for recovery may be expected in one-half of the cases.

The operative treatment consists in the removal of the tumor, with a sufficient margin of healthy tissue surrounding it.

#### **Injuries of the Tongue.**

Injuries of the tongue are seldom dangerous, though profuse bleeding sometimes ensues. The organ is frequently bitten during falls, trismus, an epileptic attack, etc., and occasionally completely severed. Injuries of external source are infrequent, owing to the protected position the organ occupies. Foreign bodies are occasionally introduced, and remain in the lingual tissues, giving rise subsequently to an enlargement suggesting a growth.

Case in which a tooth lodged in the base of the tongue for several years and simulated carcinoma. Sanford (*Jour. of Laryn.*, July, '91).

Foreign bodies in the tongue may give rise to the appearance of serious troubles. In personal case, a man of 55 presented lesion of tongue. The lateral situation, size, and hardness of lesion; absence of functional phenomena; and suspicious antecedents, all pointed to syphilitic neoplasm. A piece of pipe,  $2\frac{1}{2}$  centimetres long and 1 centimetre wide, was extracted. Derville (*Jour. des Sci. Méd. de Lille*, June 29, '95).

**TREATMENT.**—In slight or moderate traumatisms the use of ice, compression, etc., soon arrests the flow. If this does not succeed, the solution of perchloride of iron or the cautery may be tried. Profuse hæmorrhage requires ligation of the cut artery—probably the ranine, easily found usually by raising the tongue. Approximation with sutures sometimes suffices even when the hæmorrhage is quite severe, but it is usually easier to find and tie the main bleeding-vessel. Sutures should be tied with unusual care, to avoid undoing the knots by the movements of the tongue. Loose pieces heal quickly when carefully adjusted. While the wound is healing, the mouth should be kept as nearly aseptic as possible, by means of a borate-of-sodium wash (10 grains to the ounce of water) frequently employed.

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### **TONSILS AND PHARYNX, DISEASES OF.**

#### **Acute Tonsillitis.**

Acute tonsillitis, inflammation of the tonsils and adjacent structures, may be phlegmonous or croupous.

**Symptoms.**—Phlegmonous (or follicular) tonsillitis is ushered in by a feeling of dryness and stiffness in the throat, soon followed by dysphagia. There may be a chill, or chilly sensations, and pain in the legs and back, headache, and fever, which during the height of the disease may reach  $106^{\circ}$ . As the inflammation progresses, the sufferings of the patient become severe, the dryness of the throat causes frequent attempts at swallowing saliva, which are exceedingly painful. In the phlegmonous variety the mouth can be opened only with pain and difficulty, and speech becomes almost unintelligible. The tongue

is heavily coated and the breath foetid. The hearing is frequently blunted from extension of the inflammatory process to the Eustachian tubes, and abscess of the ear sometimes results. Nasal breathing is at times entirely abolished. The fever, pain, and difficulty of swallowing become greater and greater, if an abscess is forming, and the relief is proportionately great after it has opened. As the patient expectorates the pus, he feels almost well, so great is the sense of relief, the fever and pain quickly subsiding together.

**Etiology and Pathology.**—An attack of phlegmonous tonsillitis is usually the result of exposure to cold and wet; but a person who has once had the affection is more liable to subsequent attacks. The rheumatic or gouty diathesis also plays its part in the production of attacks of acute tonsillitis. And this is also true of chronic inflammation of the crypts of the tonsils, with accumulation of their secretions. It is by inoculation of the cellular tissue by such retained and decomposed masses that peritonsillar abscesses are caused, for abscess rarely occurs within the tonsil itself as the result of acute tonsillitis. Phlegmonous tonsillitis is a disease of adolescence and early adult life, and does not frequently attack individuals who are over thirty-five years of age.

In croupous tonsillitis the brunt of the inflammation is at first borne by the crypts of the tonsils, which pour out an abundant cheesy secretion, which, adhering to the surface of the tonsil, presents somewhat the appearance of a diphtheritic membrane.

Acute tonsillitis due to the infection of the streptococcus pyogenes and the staphylococcus pyogenes albus and aureus, is characterized histologically by a diffuse inflammation of the parenchyma of the organ, appearing in the form of an

increased proliferation of lymphoid cells and of the endothelial cells of the reticulum, due probably to the absorption of a toxin formed in the crypts. While bacteria are rarely demonstrable in the tonsillar tissue in cases characterized by purely proliferative lesions, yet at times infection of the interior of the follicle occurs, giving rise to circumscribed supuration and the formation of abscesses which eventually discharge into the crypts. Goodale (Jour. Boston Soc. of Med. Sciences, Jan., '99).

Follicular tonsillitis is not caused by a single microbe, but many well-known micro-organisms are capable of causing it. The symptoms of tonsillitis are partly caused by an exaggeration of its function. Under the stimulus of infection the lymph-corpuscles in the adenoid structure of the tonsil produce an anti-toxin that is antagonistic to invading germs. The characteristic symptom is an exudate having no texture and non-adherent. The presence of the Klebs-Loeffler bacillus is not positive evidence that the disease is not a simple follicular tonsillitis. There seems to be some relation between follicular tonsillitis and the infectious diseases which is not yet properly understood; whatever the function of the tonsil, it seems in disease to endeavor by its activity to assist Nature in eliminating infection. R. C. Brown (Medical Record, March 1, 1902).

**Treatment.**—A thorough application of a solution of nitrate of silver of the strength of 1 or 2 drachms to the fluid-ounce of water frequently aborts the attack, if applied early. The silver solution should be painted upon the tonsils and adjacent inflamed mucous membrane by means of a swab of cotton and in croupous tonsillitis carried into the crypts after washing them out with peroxide of hydrogen by means of a modified Blake cannula. The relief experienced by the patient as the result of the application is almost instantaneous, and the application should be repeated once or twice a day until all inflammatory symptoms have subsided. The nares and pharynx



should be washed by means of a spray from an atomizer containing Dobell's solution before making these applications, and a lozenge of guaiac and tannin may be prescribed for the patient's use in the intervals between the applications. It is best also to open the patient's bowels thoroughly at the commencement of an attack by means of small, frequently repeated doses of calomel. When these measures do not succeed in aborting the attack, but the fever and suffering of the patient are constantly increasing, aconite, in drop doses of the tincture every hour or every two hours, will give most excellent results.

At the onset of acute catarrhal tonsillitis a saline purgative should be administered and the tonsils and pharynx should be sprayed or brushed every hour with a solution of:—

℞ Formalin, 15 to 20 minims.  
Potass. chlor., 1 drachm.  
Liq. ferri chlor., 1 drachm.  
Aquæ menthæ pip., q. s. ad 4 ounces.

M. Sig.: Use as spray.

Early in the disease cold applied internally in the form of gargles or cracked ice in the mouth, and externally in the form of cold compress or ice-bag is of invaluable aid. The patient should drink frequently of equal portions of cold milk and Vichy. For the febrile condition antipyrine is to be administered, and in conjunction a capsule containing the following is given:—

℞ Quinine hydrobromat., 1 grain.  
Sodii benzoatis, 2 grains.  
Salol, 5 grains.

M. et ft. cap. No. j.

Sig.: One every three hours.

If the inflammation extends to the deeper tissues, the tonsils and surrounding structures become œdematous and interfere with deglutition. Multiple punctures and scarifications are then indicated in order to produce free bleeding, and at this stage heat applied internally, in the form of gargles and hot drinks,

and externally, in the form of poultices and fomentations, is indicated. J. H. Abraham (*Jour. Amer. Med. Assoc.*, July 21, 1900).

The official tincture of iodine applied directly to inflamed and swollen tonsils recommended. The application is followed by severe burning which lasts a couple of minutes, but which is relieved at the end of that time by gargling with plain water. Sixty-eight cases of acute catarrhal and follicular tonsillitis were successfully treated by this method. Relief from distressing symptoms was observed within five minutes after the application. Commonly the swelling and redness decreased rapidly. If used early in the disease it frequently aborts the inflammatory process. Samuel Floersheim (*New York Med. Jour.*, Oct. 5, 1901).

When pus has formed, the abscess should be opened by an incision through the anterior pillar at the upper portion of the tonsil, the so-called point of election; or at any spot where the finger detects fluctuation. Even where no pus escapes from the incision, the bleeding affords a certain amount of relief, and may bring about resolution of the inflammation.

In suppurative peritonsillitis after a thorough application of cocaine a thick stiff probe should be passed into the supratonsillar fossa. A slight pressure outward and slightly upward often suffices to make a way through the softened wall of the abscess-cavity. If pus appears, a sinus forceps may be passed into the cavity and opened. It is well to repeat this latter procedure on two successive days; in this way the pus can be thoroughly evacuated. Killian (*Münch. med. Woch.*, July 28, '96).

In an attempt to abort peritonsillar abscess, a good dose of calomel is given, followed by a saline purge. The tonsil and surrounding pillars are painted thoroughly with a 60-grain solution of nitrate of silver, and this is repeated once daily. Hot gargles of vinegar and hot water, as hot as can be borne, should be begun early, and then hot fomentations applied externally. Salol and

phenacetin always make the patient feel more comfortable. When abscess forms, it should be opened. Dunbar Roy (*Atlanta Med. and Surg. Jour.*, July, '98).

### Hypertrophy.

There are two varieties of hypertrophy of the tonsils: the ordinary soft hypertrophy found in children and young adults, and the scirrhus, or hard, tonsil, which is characterized by an enormous increase of the connective tissue of the gland and a canalicularization of its blood-vessels.

**Symptoms.**—Generally there is more or less obstruction to breathing, the patient snoring during sleep. Articulation is impeded, and there may be some difficulty in swallowing, especially in the cases of young children. The crypts of the tonsil may become filled with cheesy masses, which, undergoing putrefaction, impart to the breath an offensive odor. Hypertrophied tonsils also interfere sometimes with the proper performance of the functions of the Eustachian tubes, and thus become a cause of aural catarrh and deafness.

Study of the tonsils in a series of 375 school-boys. The tonsils were enlarged in 62 per cent.; they had caused symptoms in 33 per cent., and they produced gross disturbance of hearing in 27 per cent. The enlargement and the symptoms caused thereby were most marked between the sixth and ninth years. The percentages were much lower after the end of the ninth year. The children that progressed poorly in school were in over three-fourths of the instances those with enlargement of the tonsils. Wilbert (*Deutsche med. Wochen.*, Feb. 5, 1903).

**Treatment.**—The best treatment is removal of the major portion of the hypertrophied gland either with the tonsillotome, galvanocautery-snare, or by galvanopuncture. Occasionally the operation with the tonsillotome is followed by dangerous hæmorrhage. Care should be taken not to wound the anterior pillar

of the fauces, as it contains a small artery, which, when wounded, gives rise to troublesome bleeding. When the pillars are adherent to the tonsils, they should be carefully separated from the tonsil by means of a probe, before operating. A tonsil may be removed by means of the galvanocautery-snare almost as quickly and painlessly as with a tonsillotome and with little danger of hæmorrhage.

Scirrhus, or hard, tonsils should not be removed with the tonsillotome; owing to the hardness of the tissues surrounding the blood-vessels, a wounded artery cannot contract, and the hæmorrhage is usually long continued and may be profuse and alarming.

Tonsillectomy, by which is understood the careful dissecting away of the whole gland, is to be preferred to tonsillotomy, which as commonly performed by the tonsillotome amputates only a portion of the diseased gland.

The contrasting of these two operations shows a distinct advantage in favor of tonsillectomy, as it absolutely prevents recurrence of tonsillitis because of the removal of all of the diseased crypts with their contained bacteria. It liberates the pillars and restores the action of the soft palate, with a corresponding improvement of voice. If the operation is perfectly done, a smooth surface is left, a result not reached by tonsillotomy. It is the only practical method in those tonsils where the surface is so soft that a firm hold cannot be obtained by a tonsillotome. In more than three hundred personal cases no untoward results have been met, only one requiring attention on account of hæmorrhage. J. H. Coulter (*Jour. Amer. Med. Assoc.*, Sept. 23, '99).

Should an artery be observed to spurt after an operation upon the tonsils, the bleeding-spot should be pierced with a tenaculum, by twisting which a sufficient amount of torsion can usually be made upon the tissue to stop the hæmorrhage



until more efficient methods can be devised to control it.

In combating the severe hæmorrhage that is sometimes the result of tonsillectomy a purse-string suture may be placed about the base of the tonsil before the operation or inserted afterward if hæmorrhage is encountered. A heavy silk sterile suture is passed submucously with a curved needle and holder in four stitches about the tonsil and then tightened. It can be readily inserted under eucaïne B (10 per cent.) local anæsthesia. Dawbarn (Med. News, May 20, '99).

Treatment by galvanopuncture is performed in the following manner: A small galvanocautery-knife is introduced, cold, into one of the crypts of the tonsils, and, being heated while *in situ*, is made to burn its way out. Two or three such burns may be made at a sitting, and will be followed by considerable shrinking of the hypertrophied gland. From five to fifteen such operations are required to reduce the gland to satisfactory dimensions.

In amygdalotomy dissecting the palatine folds half-way off from the tonsil with a small electric cautery; then drawing the tonsil forward and dissecting it out thoroughly to about one-half its extent, cutting this portion off, and treating the surface with a strong solution of silver nitrate is recommended. The other portion of the tonsil is to be removed in the same manner a week or ten days later. J. Homer Coulter (N. Y. Med. Jour., No. 938, '96).

Hypertrophied tonsils may be gradually reduced to normal size by massage with the finger. The forefinger, protected by a rubber cot, should be introduced as far as possible behind the tonsil, which should be rubbed fifteen to twenty times with the finger around it, and then up and down the same number of times. The massage, repeated about fourteen times, reduces even the most inflamed and swelled tonsils considerably. Kantorowicz (Deut. med. Zeit., No. 63, '98).

The normal tonsil has a physiological function, probably protective to the organism. Being in itself often diseased, the physiological function of the tonsil is impaired, and, instead of being protective, it is the *nidus* for the growth and distribution of pathogenic organisms and their poisonous products into the system. Many grave and fatal general infections have their origin in the tonsils. If the exanthemata, especially scarlatina, are of bacterial origin, the tonsil acts in part as port of entry. Acute articular rheumatism and the diseases often associated with it, endocarditis and chorea, in a great majority of cases are due to the action of attenuated bacteria, their toxins or both entering the general system through a diseased tonsil. In rare cases of typhoid fever in which no intestinal ulcerations can be demonstrated, the similarity of the tonsillar tissue and Peyer's patches suggests the portal of entry of the Eberth bacillus into the tonsil. Scrofulosis is often associated with diseased tonsillar tissue, and the tubercle bacillus very often enters the system via the tonsils. The tonsil is too little examined at necropsy, and much light might be shed on fevers of uncertain origins by bacteriological and histological examination of it. Julius Ullman (Med. News, Jan. 26, 1901).

### Acute Pharyngitis.

Acute pharyngitis is an acute inflammation of the mucous membrane and underlying structures of the pharynx.

**Symptoms.**—The constitutional symptoms are usually trifling: A feeling of lassitude with slight fever. The throat feels sore, dry, and stiff. These symptoms increase until pain, especially when deglutition is attempted, is quite severe. The cervical glands are often swelled and painful to the touch. The voice is generally husky; and a sensation, as of a foreign body in the throat, forces the patient to often hawk and expectorate.

**Etiology and Pathology.**—Acute pharyngitis is generally the result of exposure

to wet and cold, especially in persons suffering from a rheumatic diathesis or from general debility. It may also be caused by traumatism or the presence of a foreign body in the pharynx.

The inflammation usually is not evenly distributed over the pharyngeal mucous membrane, the glandular elements always being most affected. Their secretion is at first increased, but after a time decreased, becoming starchy and glue-like in character. The tonsils are always involved, the inflammation being sufficiently marked sometimes as to cause them to mask the inflammation of adjacent structures.

**Treatment.**—A saline cathartic should be administered, in sufficient quantity to secure one or more free movements of the bowels. A solution of nitrate of silver, 1 or 2 drachms to the ounce of water, should be painted over the inflamed lateral walls of the pharynx once or twice a day. Care should be exercised not to touch the posterior wall, or the patient's suffering will be increased rather than diminished. It should be borne in mind that, while the application of a weak solution of nitrate of silver to the inflamed fauces is painful and acts as an irritant, the application of solutions of the strength of 1 or 2 drachms to the ounce of water is not painful, and is immediately followed by a sensation of relief and comfort, and tends to materially shorten the course of the disease. The application of the silver solution should be followed by spraying the parts with an 8-per-cent. solution of antipyrine. A demulcent gargle or lozenge should also be prescribed for the patient's use. When acute pharyngitis is due to the presence of a foreign body, it should, of course, be at once removed, and the inflamed pharynx treated as ordinary acute pharyngitis. When the rheumatic

diathesis exists, the administration of guaiac, either alone or combined with potassium iodide, will be found to yield most excellent results, while in gouty sore throat colchicum should be prescribed.

#### Simple Chronic Pharyngitis.

Simple chronic pharyngitis is a chronic inflammation of the mucous membrane of the pharynx generally the result of chronic rhinitis. The disease is often complicated by inflammation of the follicles of the mucous membrane, and is then called follicular pharyngitis.

**Treatment.**—It is all important to bring about a cure of the nasal disease to the presence of which the pharyngeal malady is due. After the primary nasal affection has been relieved simple chronic pharyngitis will often get well almost without treatment. During the treatment of the nasal affection, however, applications should be made to the vault of the pharynx of glycerole of tannin, 40 grains to the ounce, or of a solution containing:—

R̄ Iodine, 5 grains.  
Potassium iodide, 15 grains.  
Glycerin, 1 fluidounce.

A tongue-depressor should be used to hold the tongue down, and the patient be requested to try to breathe through his nose in order to relax the palatine muscles. The application may then be made without difficulty by means of an aluminum applicator, the end of which has been wrapped with cotton and bent to a suitable curve. Should, however, the palate lie closely in contact with the pharyngeal wall, considerable force will be required to carry the end of the applicator into the post-nasal space, while most of the solution with which the cotton on the end of the applicator has been saturated will be squeezed out and re-



main in the fauces. Applications made in such a manner irritate the parts mechanically and tend to increase the existing inflammation rather than to subdue it; and it is always best to desist from making an application to the pharyngeal vault under such circumstances.

### Atrophic Pharyngitis.

Atrophy of the mucous and submucous tissues of the pharynx frequently exists when atrophic rhinitis is present, being probably the result of an extension of the atrophic process to the pharyngeal mucous membrane; or contact with the respired air not properly warmed and moistened by the atrophic nasal mucous membrane, and dry condition of the faucial mucous membrane, amounting almost to pharyngitis sicca, is found in all mouth-breathers, but disappears spontaneously as soon as the nose has been rendered sufficiently patulous.

The patient complains that his throat feels dry and stiff. Upon inspection, the pharyngeal mucous membrane appears light colored, thin, and as if varnished. The mucous membrane and submucous tissues are so thin sometimes that the outline of each cervical vertebra can be distinguished. Masses of inspissated mucus, perhaps dark colored from the dust inhaled and swept into ridges by the motions of the soft palate, are seen adhering to the surface of the atrophied tissues.

**Treatment.**—Attention should be mainly directed to the condition of the interior of the nose, because, when a cure of the nasal affection has been brought about, the concomitant throat disease will improve almost without treatment. The general health should receive attention; and, if necessary, tonics should be prescribed, while constipation should be met by the use of saline laxatives. Iodide and bromide of

potash may also be ordered to increase the pharyngeal secretions and diminish reflex symptoms, and a weak solution of nitrate of silver (5 to 15 grains to the fluidounce) should be applied to the atrophied mucous membrane, both above and below the soft palate, to stimulate the atrophied glands to increased secretion, and bring about renewed growth of the atrophied structures. The patient should use Dobell's solution or some other bland alkaline wash as a spray through the nose night and morning in order to remove adherent secretions.

### Syphilitic Pharyngitis.

**Symptoms.**—Syphilitic pharyngitis is an inflammation of the pharynx due to the presence of the syphilitic virus, and may be witnessed during both the primary and secondary stages of the disease. Mucous patches are by no means rare, while gummata or their characteristic cicatrices are very often met with, especially in dispensary practice.

In primary syphilis examination shows a whitish sore, soon followed by swelling of the glands about the angle of the jaw. Secondary lesions may present either the form of mucous patches or erythema characterized by a diffuse redness of the entire fauces; or, in the milder attacks, by a broad red line extending upward upon each of the anterior pillars and ending abruptly and symmetrically at the root of the uvula. The red lines are almost pathognomonic of syphilis, and persist for a long time after other secondary lesions have disappeared. In secondary syphilis the larynx almost always becomes involved; the voice is hoarse, and there is a short cough of a peculiar metallic character, which, once heard and recognized, is rarely forgotten. Mucous patches and erythematous areas in the throat are almost always symmetrical,—that is, both sides of the throat are

attacked in corresponding localities by similar lesions,—while tertiary lesions do not so constantly present this symmetry. Gummata more frequently involve the tonsils or soft palate than other parts of the throat. A gumma may be absorbed under treatment, or, breaking down, result in an ulceration. When an ulcerating gumma is situated upon the posterior wall of the pharynx, the cervical vertebræ, or even the cervical cord itself may finally become involved, and a fatal issue result. In such cases also when the ulceration has involved the posterior surface of the palate, care is required to prevent union of the soft palate and uvula to the pharyngeal wall. Where union has actually taken place, it is difficult at a subsequent period to permanently restore satisfactory communication between the oro-pharynx and naso-pharynx by any operation, because of cicatricial contraction after the operation.

**Treatment.**—In pharyngeal syphilis, as in syphilis everywhere, constitutional treatment is of primary importance. If the symptoms are urgent, the hypodermic method of administering mercury should be employed, as it gives the most speedy results. Local treatment consists in maintaining perfect cleanliness of the diseased parts, and stimulating mucous patches and ulcerations to heal by daily applications of the acid nitrate of mercury, diluted with five parts of water. The remedy is effective, but painful, and almost equally satisfactory results are sometimes obtained by touching the ulcers with nitrate of silver, 60 grains to the ounce of water.

#### **Retropharyngeal Abscess.**

An abscess of the posterior pharyngeal wall may be hidden above and behind the soft palate, and require the rhino-

scope to ascertain its outline; it may be situated opposite the larynx and only be partly visible with the laryngoscope; or it may be situated in such a manner as to be hidden by one of the posterior pillars of the pharynx. However, the most common seat of abscesses is the posterior wall of the pharynx opposite the oral cavity.

It may occur as the result of phlegmonous inflammation of the cellular tissue of the pharynx, or from the breaking down of an inflamed lymphatic. Caries and necrosis of the vertebræ or temporal bone are occasional causes of the affection.

There is usually but slight systemic disturbance. Local symptoms are usually the first to attract attention, especially in infants, among whom the disease is the more common. When the abscess is situated high up upon the pharyngeal wall, a sensation suggesting the presence of a foreign body causes almost constant hawking and spitting, while there may be present obstructed nasal respiration with more or less pain and tinnitus. When the abscess is opposite the larynx, dyspnœa is a marked symptom, appearing in "spasms," which may endanger the patient's life, while swallowing of liquids or solids is dangerous, owing to their passage into the larynx. An abscess in the pharyngeal wall opposite the oral cavity presents none of these symptoms unless it is very large.

**Treatment.**—Left to itself, a retropharyngeal abscess will discharge either into the throat or at some remote point; but it should be opened as soon as a diagnosis is made, by means of a curved small trocar and cannula. Should the pus recur, an incision should be made into the abscess at its lowest part, and the opening maintained patulous by the daily passage of a probe.



**Tumors.**

Any of the varieties of tumor found in other parts of the body may occur in the pharynx. They are most frequently located in the lateral walls and may involve the surrounding structures. In the following order of frequency are found in the pharynx: Gumma, sarcoma, carcinoma, lupus, papilloma, cysts, fibroma, osteoma, enchondroma, adenoma, and aneurisms.

When the growth is large, it may become an obstruction to deglutition or even respiration. In carcinoma and ulcerating lupus, pain is present, usually radiating into the ear.

Case of a farmer, aged 62 years, who acquired an extensive fibrosarcoma of the tonsil and soft palate, which began in a small swelling above the left tonsil a few days after that organ had been pricked with a straw in use for picking the teeth. By the end of eight weeks it had developed into a large tumor occupying the left palatal arch, well down to its base, involving the tonsil and the side of the pharynx as far as the epiglottis, and up behind the edge of the hard palate as far as the left Eustachian tube. It extended forward into the mouth to within one inch of the incisor teeth. The following week the growth was removed under chloroform anæsthesia, and was found to be encapsulated. Twenty months had passed without recurrence. C. M. Robertson (*Jour. Amer. Med. Assoc.*, May 24, 1902).

Early extirpation with the knife, galvanocautery, or snare should be practiced.

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Philadelphia.

**TOXIC AMBLYOPIA.**

**Definition.**—Impairment of vision through poisoning with certain substances. It may or may not be associated with organic changes in the retina or optic nerve.

**Symptoms.**—Impairment of vision may be quite sudden or gradual. It occurs without pain or inflammation about the eye or other obvious signs. The visual field is encroached upon, and sometimes greatly limited. The failure of sight is commonly progressive, until the source of poisoning is removed, or the vision greatly reduced. If the cause is not discovered and its influence checked, optic atrophy is likely to follow.

**ALCOHOLIC AMBLYOPIA** (amblyopia ex-abusa) closely resembles that produced by tobacco. Both poisons share in the causation of many cases. Where alcohol is an important factor, the amblyopia may appear at an earlier age; and there is greater redness and obscuration of the optic disk, with subsequent atrophy of the temporal quadrant. There may also be limitation of the periphery of the visual field, and atrophy of the whole optic nerve. Methyl-alcohol also causes blindness, with atrophy of the optic nerve. The essence of Jamaica ginger, sometimes used as an intoxicant, also produces amblyopia.

**TOBACCO-AMBLYOPIA** is characterized by central scotoma, larger and more frequently complete for colors than for form. It commonly occurs after the age of forty, and is very rare in youth. It often develops when the general health is impaired, and sometimes suddenly. The ophthalmoscopic symptoms are a slight and uncertain redness and blurring of the optic disk, followed, in severe cases, by pallor of its temporal quadrant. In the optic nerve evidence of inflammatory and degenerative changes of the nerve-fibres supplying the macula has been found, and the affection has been regarded as a retrobulbar neuritis. But it is not certain that the essential lesion is of this character.

AMBLYOPIA FROM IODOFORM may occur when it is used internally in full doses or as a dressing for large raw surfaces. The visual disturbance appears suddenly after the drug has been used some time, and includes central scotoma, with obscuration of other parts of the visual field. Other symptoms of iodoform poisoning—fever; rapid, soft pulse; diarrhoea; headache; and stupor—are usually present.

AMBLYOPIA FROM BISULPHIDE OF CARBON occurs among workmen exposed to the fumes of this agent during the process of vulcanizing rubber. It closely resembles tobacco-amblyopia. The general symptoms accompanying it are: vertigo, irritability, and excitement; and, later, dejection, anæsthesia, and muscular weakness.

AMBLYOPIA FROM NITROBENZOL is marked by central scotoma and contraction of the periphery of the visual field. The pupils are dilated, the eye-ground much darker than normal, and the retinal veins dilated and tortuous. The general symptoms are headache, muscular weakness, mental disturbance, and cyanosis. It occurs in those exposed to the dust or fumes of the drug, while making certain explosives and perfumes.

QUININE-AMBLYOPIA follows the taking of large quantities of the drug, usually several drachms, but it has been encountered after use of as little as 15 grains. The general symptoms of fullness and ringing in the ears and head, deafness, etc.; these precede the blindness, which comes on only after several hours or days. Loss of sight is rapid, being usually complete in a few hours. The pupils are dilated, the optic disk white, and the retinal arteries and veins greatly contracted. The field of vision, especially the field for colors, is greatly narrowed.

SALICYLIC ACID and the SALICYLATES and ACETANILID may cause amblyopia like that from quinine.

LEAD POISONING may cause blindness, with atrophy of the optic nerve.

**Diagnosis.**—Sudden or rapidly progressive amblyopia should always raise the suspicion of a toxic origin. Inquiry will elicit the history of exposure to one of the above noxious agents. Testing the field of vision will determine the diagnosis. The especial characteristic of the one group of amblyopias, such as that from tobacco, is the central scotoma; but the patient may not at first recognize that the cloud he complains of before his sight is confined to the centre of the field of vision. In the same way, until attention is called to it, limitation of the field of vision may not be appreciated by the sufferer from quinine-blindness or similar affections.

**Prognosis.**—When exposure to the toxic influence is continued useful vision is likely to be lost. With prompt and early suspension of the poisonous agent, the loss of sight will be checked, and often practically normal vision may be regained. For tobacco-amblyopia, the chance of full recovery is very good, if the case is treated properly during the first few weeks; and after many months prolonged treatment may produce great improvement in vision. Quinine-blindness is at first complete, but almost always some vision returns, and central vision may become normal. Some narrowing of the field of vision remains permanently in all severe cases. The amblyopia from methyl-alcohol may improve for a time, and then grow worse to complete blindness with optic atrophy. In general, the severity and duration of the poisoning influences the completeness of final restoration of sight.

**Treatment.**—The first and the essen-



tial point is to stop the entrance of the poison, by total cessation of its employment in any form; the use of tobacco and alcohol, as with all other toxic agents, must be given up. The administration of iodoform, quinine, salicylic acid, or acetanilid must be suspended. Workers with carbon bisulphide, nitrobenzol, or lead must change their occupations. The elimination of the poison may be hastened by potassium iodide in moderate doses, Turkish baths, and pilocarpine sweats. The general health should be looked after at every point. Strychnine is to be given in increasing doses up to the limit of tolerance.

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### TOXIC FOODS.

**Ptomaines and Toxins.**—The word *ptomaine* has been pretty generally abandoned as inapplicable to the toxic elements of decomposition it was intended to represent. Although it implies the presence of a poisonous product, it is now known that many ptomaines—cholin, neuridin, putrescin, etc., for instance—are not poisonous, though extracted from dead bodies. The term, therefore, fails to isolate the truly toxic products such as neurin, present in decomposing meat; peptotoxin, found in some peptones; muscarin, found in the *Amanita muscaria* mushroom, the venom of snakes, etc.; and the term “toxin” has therefore been generally adopted to distinguish the latter group, just as it has to another group associated with the pathogenesis of various affections, such as diphtheria, cholera, etc. Upon a special group of toxins, originating in the putrefaction of proteid substances, through the metabolism of putrefactive bacteria of dead bodies, therefore, mainly depend the effects of toxic foods.

When these toxins (nitrogenous bases) are compared to alkaloids (vegetable bases), many of which, aconitine, conine, veratrum, etc., are well known to the practitioner, they may be said to be at least very similar, no reliable test, capable of distinguishing them as a group from these, having, as yet, been discovered. Indeed, toxins of putrefaction have been taken for vegetable alkaloids by expert toxicologists.

The writer reports an epidemic of what was probably ptomaine poisoning which affected ninety pupils of the Whittier State School. That some common form of poisoning occurred is unquestionable, as so many were affected. In only six were the symptoms grave. The epidemic began on Friday morning by two boys reporting at the hospital, complaining of pain in the stomach and head, at the same time saying they had passed a sleepless night. At 8 o'clock of the same day five more boys reported. They were all looking pale, and all had vomited and complained of pain in the epigastric region. These boys had hardly been cared for before ten more came in in the same condition. By noon forty-five boys were in the hospital and adjacent dormitories. The treatment given was calomel, hot water, and all food was interdicted. Most of the attacks terminated in severe diarrhœa. A fairly constant symptom was a semi-comatose state, from which the patients were with difficulty aroused. The temperature in some cases reached as high as 105.5° F. W. V. Coffin (So. Calif. Pract., Sept., 1903).

The toxins begin to develop in the dead body about twenty-four hours after death when the latter is due to normal causes, though a diseased animal may show evidences of putrefaction much sooner. The putrefactive process continues until complete disintegration and chemical transformation of the organic tissues occur, one class of toxins being

replaced by others which are frequently of greater toxicity. When a sufficiently active dose—less than one-hundredth of a minim in the case of some toxins—is introduced into the human organism through the agency of tainted or putrid foods, illness may prevail.

The likelihood of toxic symptoms depends to a great degree upon the condition of the animal partaken of at the time of its death. Thus, spoiled or tainted veal, obtained from healthy animals, rarely gives rise to serious accidents. But if, as is frequently the case, the animal, when slaughtered, suffered from pyæmic or septicæmic inflammatory processes, or septic diarrhœa, grave symptoms may occur in the person partaking of it.

While many cases of poisoning may be attributed to toxins,—*i.e.*, bacterial products,—living bacilli such as are ingested with contaminated water in the case of typhoid fever or cholera may also be productive of poisoning when food containing them is used. We have in the toxic oyster an example of food acting as the medium for the transportation of an infectious germ, though, in all probability, the mollusk itself is not diseased. When, going a step farther, we closely examine the clinical history of most cases of cholera morbus and compare it to that of food poisoning, the resemblance is so great that we cannot but be led to conclude that in at least many cases of the former disorder we are in the presence of food infection, in an individual unduly susceptible, perhaps, to the micro-organism that may be present, or to its toxin. This would tend to suggest that many more cases of food-infection are met with, in practice, than is generally believed.

Foods of all kinds may thus become the source of toxic symptoms through

the effects of putrefaction; they may transmit various micro-organisms: those of tuberculosis, typhoid fever, trichinosis, etc. Vegetable matter used as food, grains, fungi, etc., represent exceptions to this rule.

Outbreaks of disease due to meat poisoning are dependent upon infections by living bacilli. Only two kinds of bacilli are definitely related to the etiology of such outbreaks, namely: the bacillus enteritidis of Gärtner and the anaërobic bacillus butyricus of van Ermenghem. Of these the former is the more important. Whenever the source of the illness was traced, the animal supplying the meat was found to be diseased. The cow and the calf are the animals especially liable to furnish the bacillus. Herbert E. Durham (Brit. Med. Jour., Dec. 17, '98).

**Meat Poisoning.** — SYMPTOMS. — The symptoms produced by poisonous meat may be grouped in two divisions: (1) those due to a true infection; (2) those due to simple poisoning. In the first division the train of symptoms runs the usual course of an infectious disease, as shown by the occurrence of symptoms suggesting typhoid fever in a large number of people who had eaten of meat from an animal killed while moribund. In the second division the symptoms usually resemble those due to acute gastro-enteritis: violent vomiting and purging; rapid loss of strength, with extreme depression; cramps in the calves of the legs; and general coldness of the surface, with subnormal temperature. In these cases the average prodromal period is shorter than in those of Class 1, and the acute stage of the illness does not exceed a few days at the longest. (Mann.)

The histories vary considerable, however. Diarrhœa is not always witnessed, neither is vomiting a feature, probably depending upon the intestinal area in-



volved (Durham). At times the temperature is raised. Pneumonic symptoms may also appear, while the frontal cephalalgia and marked symptoms of influenza may suggest the presence of this disease. Great weakness attends all cases. Herpes labialis, rashes, and desquamations occasionally follow the active period.

ETIOLOGY.—Any kind of meat, beef, mutton, lamb, etc., may, when more or less putrid, give rise to symptoms of poisoning, but various combinations or modes of preparation show a special tendency in this direction. Sausage poisoning prevails especially in Germany, where outbreaks are quite frequent. Pork-pie, ham, and veal-pie represent prolific causes of poisoning in England and France. Any kind of fowl—turkey, chicken, goose, etc.—may be recorded among the foods that have given rise to serious poisoning,—though in some cases no evidence of putrefaction could be discerned. An outbreak of typhoid may be suspected in wholesale poisoning, as in the memorable case at Sabina, Iowa, in which forty or fifty guests at a wedding banquet who had partaken of a chicken-salad were attacked by what seemed to be in many cases typical typhoid. This claim was actually set up as part of the defense in the numerous damage suits that were brought.

Meats mainly acquire toxic properties through delay in their use as food after slaughtering of the animals from which they are obtained; and imperfect preservation, whether this be by means of freezing, canning, salting, or smoking, plays its part in this, merely because it imperfectly counteracts the putrefactive process: *i.e.*, the formation of toxins. We have also seen that infection can also be due to disease of the animals or to infection of the meat before ingestion.

All these features are to be considered simultaneously when prophylactic measures are to be instituted.

PROPHYLAXIS.—In Paris the seizure of meat is considered justified and is made (1) when deprived of all edible qualities; (2) when its ingestion might be followed by injurious consequences; (3) when from some reason or other it has derived qualities rendering its taste repugnant. Under the first head comes the flesh of animals that have been killed too young, and of those that are either dropsical or cachectic; under the second, that of animals affected with disease, such as fever, septicæmia, anthrax, tuberculosis, etc. The signs which guide the inspector in condemning the flesh of cachectic animals are chiefly the wasted condition, the absence of fat about the omentum, and the lack of resistance in the muscular tissue. With regard to animals that have died of inflammatory diseases the signs are: 1. A general tarnished coloration, more or less deep red. 2. A capillary injection of the fat, which in extreme cases is penetrated deeply by it. 3. Arborescent markings on and a tendency to a livid coloration of the serous membranes. 4. A violet tint of the kidneys. 5. A brown or blackish coloration of the spongy bone, seen best in the vertebræ. 6. Loss of firmness in the muscular tissue.

In Brussels the conditions under which the flesh of tuberculous animals is seized, no matter how good its general condition, are: 1. (a) Tubercle having its seat in both thorax and abdomen; (b) tubercle, whether it be thoracic or abdominal, with presence of tubercles in any other part of the body outside these cavities; (c) tubercle generalized in the following organs: lungs, pleuræ, peritoneum, liver, or mesenteric glands; (d) tubercle of the lungs or pericardium in-

volving the pleura extensively; (e) tubercle of any organ of the abdomen involving the peritoneum extensively. 2. Tubercle observed in no matter what part of the body, or what the number of tubercles, when the animal is markedly wasted.

No slaughtering can take place in Berlin except at the abattoir, and no meat can be sent away from the abattoir without first being stamped as having passed the expert examination. The inspection is entirely in the hands of veterinary surgeons. They make, first, a rough inspection of the carcass and cut into the glands of the neck, especially the retropharyngeal. The liver and lungs of every animal must also be cut into. If the appearances are suspicious, the surgeon further examines the spleen and the various glands of the body. The flesh of all animals affected with tuberculosis, but not so extensively as to justify total seizure, and of those in which only a few cysticerci are found, is cooked for two hours in boiling water, and twice a week sold to the poor for a trifle.

In Copenhagen, also, a slaughter of animals can take place only at the slaughter-house, where the veterinary inspection is made. All the animals are first inspected as they stand in the market, and any animal found with dangerous infectious disease is isolated and slaughtered apart from the others. None of the organs may be removed until the veterinary surgeon has made his rounds. The latter, after a general inspection of the carcass, cuts into the glands of the neck, examines the pleuræ, peritoneum, lungs, and liver, and, should there be nothing wrong with them, allows the meat to be stamped with a blue mark, as of good quality. If he find any inflammation or suppuration about them, he undertakes a methodical ex-

amination not only of those of the neck, but also of the submaxillary, axillary, bronchial, mesenteric, inguinal, and lumbar glands. Cysticerci are always looked for by cutting into the muscles at the root of the tongue. Tubercle, when generalized, is deemed a sufficient cause for seizure, but not when localized. A black stamp is freely used to mark meat as of second-class quality which is not considered sufficiently diseased to warrant seizure.

**Shell-fish and Fish Poisoning.**—**OYSTERS.**—Of late this mollusk has occupied quite a prominent place among the toxic foods. In temperate zones such effects are seldom witnessed, but in tropical and subtropical countries oysters, which can be eaten without danger at certain times, become poisonous at others. In temperate zones, therefore, the toxicity is not, as a rule, inherent in the oyster, it is due to sewage-contamination or to infection of the pit in which the shell-fish is stored through insufficiently frequent renewal of the water.

Result of an examination of a sample of water taken from one of the oyster-pits in which oysters were kept awaiting sale, and in which the water had been allowed to stand unchanged for several days. The original water contained about 400 micro-organisms per cubic centimetre, whereas in the stagnant water these had increased to over 10,000. Artificial pits for the storage of oysters should be either situated between high and low tide, and so get their waters renewed every twelve hours, or, if placed beyond the reach of the ordinary tides, provision should be made for the frequent renewal of the water; oysters should be consumed as soon as possible after leaving their beds. David Houston (Jour. Essex Technical Laboratories; Brit. Med. Jour., Dec. 19, '96).

To oysters, as is well known, have been traced cases of typhoid fever (see



**TYPHOID FEVER, ETIOLOGY**, in this volume). In a case recently reported by Renon marked urticaria developed, accompanied by a sharp attack of arthritis.

**MUSSELS.**—Mussel poisoning may be due to a toxin, mytilotoxin, found chiefly in the liver of this shell-fish; or to contamination through a prolonged sojourn of the latter in foul waters. Here, however, the symptoms vary somewhat from the classical manifestations, in that the nervous system seems to be more actively involved, profound collapse ensuing rapidly.

**SHRIMPS AND LOBSTERS.**—Potted shrimps (*Lancet*, Sept. 17, '98) recently caused forty persons to suffer from violent gastro-intestinal symptoms at St. Ann's-on-the-Sea. In this region the shrimp-nets are piled for some miles along the coast, where a deep channel divides the foreshore from the shallow banks. It is said that the shrimps were caught, potted, and used the same day. No deaths occurred, though some of the cases were serious. The fishermen contend that the shrimps were caught where there could be no sewage pollution.

Lobsters and crabs are, of shell-fish, those most feared, but, judging from the few cases of poisoning credited to them, it is probable that they are no more toxic than other edible substances of the same class. Symptoms of typhoid may not only prevail, but the Widal test may sustain such a diagnosis, as in a case reported by Shram (*Medical News*, Nov. 20, '97).

**FISH.**—Cases of poisoning by salted salmon have been reported. Out of eleven cases witnessed by Arnstamoff, five died. The fish was not putrid, though peculiarly soft. The chief symptoms, which developed in ten to twenty hours after the ingestion of the fish, consisted of general weakness, abdominal

pains, dyspnoea, mydriasis, diplopia, vertigo, dryness in the mouth, dysphagia, aphonia, obstipation, anuria, and reduction of temperature. The pathologico-anatomical examination showed nothing specific other than death from asphyxia. The microscopical and bacteriological examination of the organs demonstrated the presence of a large number of micro-organisms which bore considerable resemblance to the typhoid bacillus.

The salted sturgeon has also proved fatal to many persons in Russia, the bard in central Europe, and the tetrodon in China and Japan. Some of the varieties of the latter fish are extremely toxic, causing death in some cases in less than an hour. The poison may be either due to a venomous glandular secretion or to bacteria or their toxins.

**Cream and Cheese.**—The toxic effects of milk have been considered in various articles, particularly under **INFANTS, DIARRHOEAL DISEASES OF** (volume iii), and **TYPHOID FEVER** (volume vi), and the reader is referred to these.

Epidemic of milk poisoning. In one village 5 families consisting of 12 persons were attacked; 2 children died. In another village 17 persons living in 5 different houses showed symptoms of severe gastro-enteritis and collapse, the symptoms coming on always about three hours after taking milk which was supplied by one milkman from one can. The goats from which the milk was obtained were entirely healthy. The cans had been washed, but they had a sour odor, and bacteriological examination of them showed a bacillus which had all the characteristics of *bacillus enteritidis sporogenes*. T. Zammit (*Brit. Med. Jour.*, May 12, 1900).

Ice-cream dealt out in the streets of London by itinerant vendors frequently causes death among the poorer classes. The cold of this food benumbs the sense of taste, and the combination of stale eggs and sour cream passes unnoticed

down the gullet of the victims, almost invariably children. The quarters of the vendors are, as a rule, filthy, thus affording a prolific source of contamination. The symptoms do not vary from those already described: the manifestations of acute gastro-enteritis.

Analysis of forty-nine samples of American green cheese. A bacillus of the colon group was found in every sample. As to whether opium does harm if given in the vomiting and purging from tyrotoxic poisoning, experiments on guinea-pigs with the bacillus obtained from cheese showed that a beef-tea culture killed only those animals which received  $\frac{1}{4}$  grain of morphine hypodermically. Vaughan and McClymonds (Jacobi Festschrift; Phila. Med. Jour., May 26, 1900).

Study of about two hundred persons poisoned by cream-tarts. The symptoms were those of gastro-intestinal irritation, and varied considerably in intensity, resembling in some arsenical poisoning. All recovered. A bacteriological examination of the cream-mixture—which is usually composed of milk, eggs, sugar, flour, and pastry—showed the presence of streptococcus pyogenes aureus of unusual virulence. A series of experiments established the fact that, when the cream-mixture becomes sour and is kept in a very warm room, the pyogenic cocci, with which such mixtures are liable to become contaminated, develop very rapidly. Lashenkow (Vratch, Mar. 10, 1901).

The colon bacillus is present in practically all samples of American green cheese, and cultures of this germ may be boiled without destroying its toxicity. The toxin is contained within the germ-cell, from which it does not, at least under ordinary conditions, diffuse into the culture-media. The toxin is not extracted from the cell by either alcohol or ether. Very dilute alkalies do not extract the toxins from the cells. The germ-substance may be heated to a high temperature with water without destruction of the toxin. V. C. Vaughan (Amer. Med., May 18, 1901).

### Treatment of Toxic-Food Poisoning.

—The first indication is to remove the offending matter from the alimentary canal. Thorough washing out of the stomach, as soon as possible, with a siphon-tube till the washings come away clear is advised. While the good effect of this is apparent, a few cases may relapse within a couple of hours. A second washing in these cases prevents the occurrence of further relapses. Stimulants, chiefly in the form of brandy and strychnine, may then be administered, and an attempt made to clear the bowel of its irritating contents by castor-oil or other purgatives. In many cases, especially if symptoms of collapse supervene, the use of external heat (hot-water bags or hot bottles) will be found useful in conjunction with the brandy and strychnine, which is best given hypodermically.

### Grain and Vegetable Poisoning.—

ERGOT.—Rye often becomes the host of a fungous parasite, *Claviceps purpurea*, when grown on virgin soil or when the soil is carelessly cultivated. Consumers of rye-bread, especially numerous in some parts of Europe, are therefore exposed to its effects, and epidemics of ergotism have thus been caused, and are apt to occur immediately after harvest. These are attributed to two active principles: cornutin and sphacelinic acid.

Cornutin gives rise to marked nervous symptoms, the earliest of which are headache, formication in the extremities, and great weakness. These symptoms gradually increase in intensity until cramps, convulsions, contractures, delirium, and sometimes dementia, and symptoms of spinal sclerosis appear. Abortion also occurs in pregnant women. When a change of diet is resorted to, the symptoms gradually subside, but when the disease has induced contracture, the latter is overcome with diffi-



culty. Sphacelinic acid, on the other hand, is thought to cause gangrene, beginning at the hands and toes, and preceded by formication, pain, spasm, anæsthesia, and coldness. The disease proceeds as does true gangrene and is often complicated with pulmonary infarcts or septic pneumonia, followed by early death.

**CORN.**—Contaminated cornmeal bread often causes, especially in Italy and Spain, a disease termed *maidismus*, or *pellagra*, attributable also to putrefactive changes and to the formation of toxins. It is generally observed when fresh, moist cornmeal is used. The early symptoms are mainly gastro-intestinal and cutaneous: indigestion, diarrhoea, anorexia, general weakness, roughness of the skin, and erythema, sometimes complicated with the formation of superficial abscesses. Later on, marked nervous symptoms appear: spasm, paraplegia, cephalalgia, delirium, or hebetude, sometimes attended with exacerbations of violence with suicidal tendencies. Death from marasmus or some complication is apt to occur if the introduction of the toxic principle is continued.

**CHICKEN-PEA.**—This seed is often mixed with others used as food, and may cause, after prolonged use, nervous disorders of spinal origin, transverse myelitis especially.

**SPROUTING POTATOES.**—These may at times contain a poison, solanine, an alkaloid of its botanical group, resembling in effects those of belladonna, stramonium, hyoscyamus, and tobacco. Pfuhl recently reported the cases of sixty German soldiers who became ill at the same time with symptoms of gastro-enteritis after partaking of some cooked sprouting potatoes. The symptoms were collapse, prostration, with more or less

jaundice. During sprouting much more solanine is developed. In using such potatoes care should be taken to thoroughly peel the vegetable and take out the "eyes" deeply, thus minimizing the danger. Pfuhl attributes many mild cases of acute indigestion and diarrhoea to this cause.

**Treatment of Grain and Vegetable Poisoning.**—This limits itself to removal of the cause and to treatment recommended under the previous heading.

**Mushroom Poisoning.**—Probably the most dangerous feature connected with the use of fungi as food is the belief that the ordinary tests utilized in the average household are at all reliable. Depending upon the taste or odor of the mushroom, or the fact that it does not blacken a silver object while cooking, merely detracts the attention from the only comparatively trustworthy tests: the botanical characteristics. This implies the necessity of adequate knowledge in mushroom gatherers. That more cases of poisoning do not occur is because those who supply green grocers and other dealers either cultivate them or limit their selection to fungi of a few kinds known to be generally used with impunity. Safety lies with them in the self-imposed restriction of not picking mushrooms with which they are not absolutely familiar. Amateur gatherers are to be feared in this connection; and it is always best to refrain from using mushrooms obtained from such a source unless the gatherer be known to possess due competence.

A novice who proposes to gather mushrooms for himself should never use a species for food until he has found out positively its name and its non-poisonous character. He should then familiarize himself with this species until he knows it from all others as certainly as he knows

the cabbage, the turnip, the cauliflower, or any other of our common vegetables. He should confine himself rigidly to this his personal edible list, and should add to it only as thus recommended. His authority for the name and qualities of each kind he adds to this list should be some person having an unquestioned expert knowledge of mushrooms. There is no single test and no safe series for poisonous mushrooms. F. V. Coville (Division of Botany, United States Department of Agriculture Circ. No. 13, '98).

There is only one rule to be followed in avoiding poisonous mushrooms, and that is to know that the particular variety is safe because it has been eaten with impunity. That is, the one who picks the mushrooms should be able to say that he knows a kind to be good, not because it has this or that characteristic, but because he recognizes it as one that he has tried. Editorial (North-western Lancet, Jan. 1, '98).

**Edible Mushrooms.**—Four varieties of mushrooms were found in Washington markets by Mr. F. V. Coville, Botanist of the United States Department of Agriculture. These about represent the kinds generally sold elsewhere in the country and with which most persons are familiar. They do not, however, include all the edible fungi, but a series within which safety always lies, provided no idiosyncrasy in the consumer, insufficient cooking, or injudicious consumption, especially by children, intervene to give rise to untoward effects. Indeed, death has resulted under such circumstances from the use of perfectly-identified edible mushrooms.

In fresh specimens the surface of the *Agaricus campestris* (Fig. 1) is white, but various shades of the light brown, either plain or checked, are often found. The gills in a newly-expanded mushroom fresh from the field are of a beautiful and delicate pale-pink color, often with a tinge of salmon. The gills end toward the centre with an abrupt upward curve without being attached to

the stem as in some other kinds of mushrooms.

As they grow older, especially after they are picked, the gills turn in a few hours to a light brown and finally to a dark chestnut-brown, almost black, color. The usual diameter of fully-expanded specimens of the common mushroom is one and a half to three inches, though smaller and larger specimens are sometimes found. When one day old, a mushroom is usually still edible, but insect-larvæ soon attack it, traveling up through the stem into the cap, and decomposition rapidly follows.

About Washington the common mushroom occurs oftenest on lawns and in pastures and especially in neglected fields where weeds have been succeeded by a scant covering of grass. F. V. Coville (Circ. No. 13, Division of Botany, U. S. Dept. of Agriculture, '98).

While the horse-mushroom (*Agaricus arvensis*, Schaeffer—Figs. 2 and 3) agrees in most details with the common mushroom, the surface of the cap is darker colored than in *campestris*, though specimens of a considerably lighter shade of brown are often found; it is larger, and the ring is wider and thicker than in the other. Usually the ring is distinctly marked on its upper surface by a series of lines where the edges of the gills before expansion have pressed against it. The horse-mushroom is not always distinguished from the common mushroom by the market people, and, indeed, in its technical characteristics it is closely related to that species. Its characteristic place of growth about Washington is not in fields, but in gardens, especially very rich or heavily fertilized ones, where it often occurs in cold frames or around hot beds. F. V. Coville (Circ. No. 13, Division of Botany, U. S. Dept. of Agriculture, '98).

In the fairy-ring mushroom (Fig. 5—*Marasmius oreades*, Bolt, Fr.) the stem has no ring. The gills are comparatively few and far apart; and the cap, as it becomes widely expanded, has a peculiar knob-like projection in the centre. The cap and stem have a pinkish-buff color, and the gills a lighter shade of the same, varying in its younger stages toward a



cream color. The spores are white, and in ascertaining their color the cap should be laid on some dark-colored, preferably black, paper. The fairy-ring mushroom is one of the commonest species on the lawns in the city of Washington. In general, they can be found in any old and well-kept lawn. The ring (Fig. 4) is due to the uniform annual growth of the mycelium. This, starting at a central point, grows each year a few inches outward, the older portion beginning to die at the centre. Thus a small circular band is formed and each year this increases in size, growing regularly on the outside and dying as regularly on the inside.

The fairy rings, except when young, seldom form complete circles, usually appearing as broken rings or crescents. Several crops of mushrooms are produced on a single ring during a season. The most abundant crop coming after the autumn rains. F. V. Coville (Circ. No. 13, Division of Botany, U. S. Dept. of Agriculture, '98).

Not only are the spores of the shaggy mushroom black, but the whole plant, beginning at the outer edge of the cap, dissolves when the mushroom is about a day old, into an inky-black fluid (Fig. 6). Some of this inky fluid has dropped from the large specimen upon the small one at the left and has run down its stem. At the right is a specimen showing the characteristic appearance of the cap which, except in its latest stages, has somewhat the form of a closed umbrella. In their early stages the cap, gills, and stem are white, excepting frequently the apex of the cap, which is often dark-colored, as in the figure. The surface of the cap is covered with delicate lacerated scales. The ring is only very loosely attached, either to the stem or to the margin of the cap, and sometimes is wholly free from both, early dropping down to the base of the stem. In the white part of the cap the juice is as colorless as water; toward the margin it is wine colored. In this stage the mushroom is still in condition to be eaten, but when the juice turns black the mushroom is too old for the table. This mushroom has as its favorite place of growth, not fields and pastures, but shaded situations,

where the ground is rich or well supplied with thoroughly decomposed wood or other vegetable matter.

It grows in greatest abundance in the low grounds near the Potomac, shaded by willows or rank weeds. The season of greatest abundance is the late autumn, in November and early December. F. V. Coville (Circ. No. 13, Division of Botany, U. S. Dept. of Agriculture, '98).

The exterior color of the puffball, edible (*Lycoperdon cyathiforme* bosc) is brown (Figs. 7 and 8), and the outermost part of the covering is usually more or less distinctly and irregularly checked, the white color of the interior showing between the darker, raised areas. Within at its earliest stage the flesh is of a milk-white color, solid, and without an appreciable juice. Within two or three days it becomes soft, turns yellowish, develops a watery and later an amber-colored juice, and continues its development through later stages.

In the left-hand specimen of Fig. 9 the entire contents have changed from yellow to brown, the juice has dried out, the outer coatings on the upper part have been broken up and blown away, showing only in brown and gray at the lower edge of the specimen, and the interior mass of dust-like spores and fluffy, minute brown threads exposed to the air.

Other species of puffball grow in the District of Columbia, but only two others, so far as known, approach this in size. The small species are commonly an inch or less in diameter, while the commoner of the two large species has an almost pure white surface, and when old the spores it produces, like those of the other large one, are yellowish brown instead of purplish brown as in the present species. None of the puffballs with a pure white interior are known to be poisonous.

About Washington puffballs are found commonly in the autumn on lawns and in pastures, especially upon the vacant lots at the edge of the city serving as "commons," where the soil has remained undisturbed for many years and has been closely grazed by cattle. F. V. Coville (Circ. No. 13, Division of Botany, U. S. Dept. of Agriculture, '98).



Fig. 1.—Common mushroom (*Agaricus campestris*). Edible. Three-fourths natural size.



Fig. 2.—Horse-mushroom (*Agaricus arvensis*). Edible. One-half natural size.

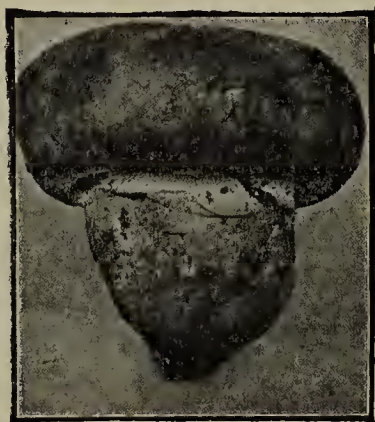


Fig. 3.—Horse-mushroom (*Agaricus arvensis*) button. Edible. Three-fourths natural size.





Fig. 4.—Fairy ring formed by *Marasmius oreades*: an edible mushroom.

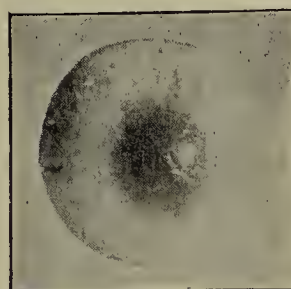


Fig. 5.—Fairy-ring mushrooms (*Marasmius oreades*) viewed from several directions. Edible. Three-fourths natural size.



[If there is any suspicion through lack of confidence in the dealer, etc., that the mushrooms on hand might be toxic, the following process, used by market-women in Washington, according to Mr. Coville, can be employed before they are prepared for food. The stem is scraped, the gills are removed, and the upper part of the cap is peeled. The mushrooms are then boiled in salt and water—which removes any toxalbumin that may be present,—then steeped in vinegar—which removes the alkaloid. ED.]

**Poisonous Mushrooms.**—The toxic effects of mushrooms are mainly due to two alkaloids: muscarine,—formed by the oxidation of choline in the *Agaricus muscarius*,—and phalline, contained especially in the *Amanita phalloides*. Phalline is a toxalbumin of extreme violence, and is a poison also found in some venomous animals, such as the rattlesnake. In both species of mushrooms, however, there are other chemical substances whose nature have not as yet been determined.

The fly-amanita, poisonous (*Amanita muscaria*), is the commonest of the poisonous mushrooms of the District of Columbia. The points especially to be noted are the bulbous enlargement at the base of the stem, breaking into thick scales above, the very broad drooping ring near the top of the stem, and the corky particles loosely attached to the smooth, glossy, upper surface of the cap. The stem, the gills, and the spores are white, the corky particles commonly of a buff color, but varying sometimes to almost white. The glossy, upper surface of the cap, beneath the corky particles, varies from a brilliant red to orange yellow, and even white. Commonly in the vicinity of Washington the coloration is orange in the centre, shading to yellow toward the margin. Brilliant-red ones are rarely seen here, but white ones are of not infrequent occurrence, especially late in the season. It sometimes happens that the corky layer does not break up into particles, but simply stretches as the cap expands. Such a specimen, if it is of a pale-buff or white color, would not be

taken by a novice as belonging to the same species as the brilliant-orange or red specimens, and a mistake might easily be made. Often, too, the bulbous scaly base is broken off in picking and even that characteristic is lost. Another feature usually present in the fly-amanita is the striations on the upper side of the cap near the margin.

This is one of the largest, handsomest, and most dangerous of our mushrooms.

It is abundant about Washington in the fall, growing in pine-woods, a favorite situation in these woods being the vicinity of abandoned hog-beds. F. V. Coville (Circ. No. 13, Division of Botany, U. S. Dept. of Agriculture, '98).

The stem of the death-cup, poisonous (*Amanita phalloides*), is set in a sort of white cup, the upper portion of which surrounds the base of the stem like a collar. This species resembles muscaria in its broad ring and in the white color of its stem, gills, and spores. The upper surface of the cap, however, is usually smooth and without corky particles, glossy, viscid, and of a white or slightly-greenish, sometimes even yellow, color. Occasionally a few small and irregular patches are found on the top of the cap, consisting of fragments of the upper portion of the cup, which became attached to the top of the mushroom when it was very young and just pushing itself out of the ground. The presence of the cup which this species possesses, in common with other supposedly poisonous, is especially characteristic. It is usually situated well beneath the surface of the ground and should be carefully dug out when one is securing specimens for identification. Specimens occur, however, in which the inner surface of the cup is attached throughout to the stem, so that it presents the appearance, not of a cup, but of a mere bulbous base.

The death-cup is a species not so abundant in the vicinity of Washington, yet of rather frequent occurrence in rich oak-woods. At Takoma Park it occurs in abundance. F. V. Coville (Circular No. 13, Division of Botany, U. S. Dept. of Agriculture, '98).

Both the species of poisonous mushrooms described have, as noted by Mr.



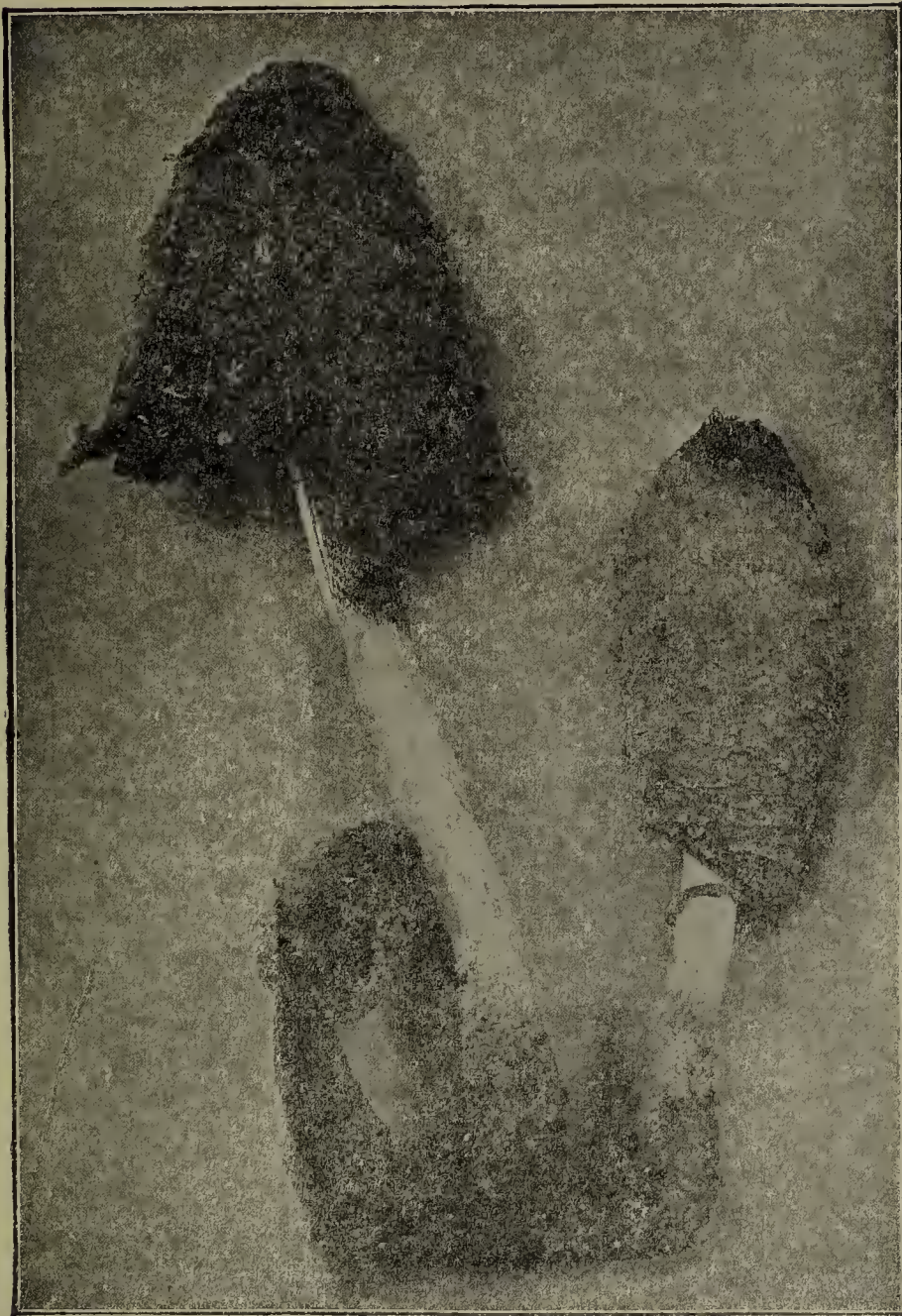


Fig. 6.—Shaggy mushroom (*Coprinus comatus*). Edible. Three-fourths natural size.



Fig. 7.—Puffball (*Lycoperdon cyathiforme*), side-view. Edible. Three-fourths natural size.



Coville, *white gills and white spores*, while all the edible gill-bearing species herein described, except *Coprinus comatus*, have gills of some other color. In *Coprinus comatus* the spores at maturity are black. Several species of mushrooms having both white gills and white spores being edible, however, Mr. Coville urges that a beginner should not pick them, as he might easily mistake an amanita for them.

A high color, a scaly or spotted surface, and tough or watery flesh are

alkaloid—that present in *Amanita muscaria*—are mainly of cerebral origin. After a period varying from half an hour to fifteen hours, giddiness is experienced, and nausea, with salivation, vomiting, cramps, diarrhoea, dimness of vision, and dyspnoea follow in quick succession. The stools sometimes contain fragments of the fungus. The patient appears drunk and excited, then drowsy. These symptoms are usually the precursors of convulsions, and are preceded by anuria. Cardiac action is weakened, and the

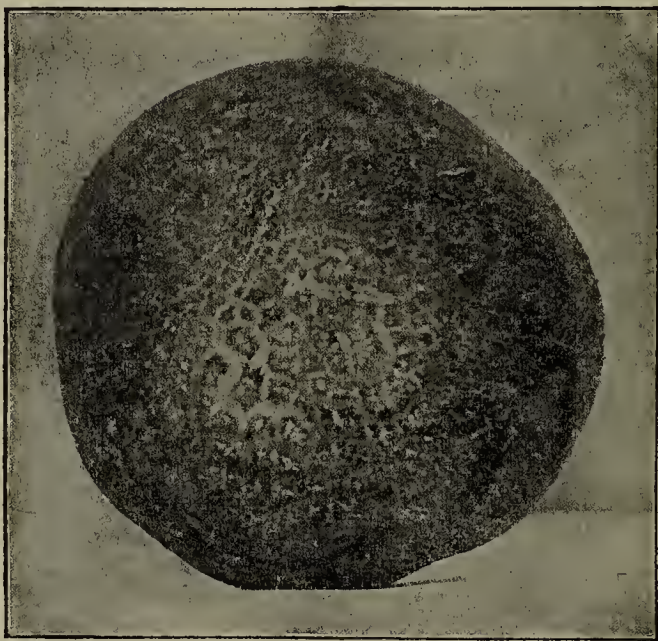


Fig. 8.—Puffball (*Lycoperdon cyathiforme*), top-view. Edible. Three-fourths natural size.

usually associated with poisonous properties. Toxic fungi, moreover, grow clustered on wet or shady ground, the edible, singly, in dry pastures.

Fungi which have a bitter or styptic taste, or which burn the fauces, as well as those which yield a pungent milk, those of livid color, and those which on being bruised assume various hues, ought to be avoided. It should be remembered, also, that all plants of this class readily undergo decomposition, and should therefore be eaten as fresh as possible. Editorial (Lancet, May 30, '91).

**Symptoms of Muscarine Poisoning.**—The symptoms of poisoning from this

pulse is slow and thread-like. The pupils, at first contracted, become dilated as death approaches. The reflexes are, in part or quite, abolished, and cold sweats appear. Respiration gradually becomes more difficult and stertorous and the pulse finally becomes imperceptible, and death occurs either in coma or in the midst of a convulsion.

In favorable cases the stupor is not of long duration, the respiration and pulse are more active, and all the symptoms mentioned gradually disappear. In unfavorable cases the symptoms may





Fig. 9.—Puffball (*Lycoperdon cyathiforme*), viewed diagonally from above. One-half natural size. Not edible in this stage.



Fig. 10.—Fly-amanita (*Amanita muscaria*). Poisonous. One-half natural size.



progress rapidly or slowly, some cases dying a few hours after the first manifestation, others lasting two or three days.

Six cases of poisoning by the *Agaricus muscarius*. The six cases all occurred in one family and three were fatal. The mushrooms were eaten at about six in the evening. The first symptoms appeared in all the cases during the forenoon of the following day, and took the form of vomiting and diarrhoea. In most of the cases these symptoms were slight. All felt dull and stupid on awakening, and there was a feeling of dyspnoea which led them to seek the fresh air. One patient, a child, died during the evening of this day with convulsions. The two others who died (also children) showed no serious symptoms until the morning of the second day. At this time there was mental dullness, increasing to stupor, rapid, empty pulse; contracted pupils, irresponsive to light; rapid respiration, suppression of urine, and free perspiration.

One died on the first, one on the second, and one on the third day after the poisonous meal. The fatal dose in all of these cases was but a small one—in two cases but  $\frac{1}{2}$  of a medium-sized mushroom, and in the third case but  $\frac{1}{6}$ . The members of the family who escaped ate as much or more of the mushrooms, and it is supposed that there were but one or two poisonous fungi in the dish; that those who died ate these, while the others ate good mushrooms that were rendered somewhat poisonous by being cooked together with the bad. G. E. Caglieri (Med. Rec., Aug. 28, '97).

In case of rapid recovery the stupor is short and usually marked with mild delirium. In fatal cases the stupor continues from one to two or three days and death at last ensues from the gradual weakening and final stoppage of the heart's action. V. K. Chestnut (Circ. No. 13, Division of Botany, U. S. Dept. of Agriculture, '98).

**PHYSIOLOGICAL ACTION.**—According to D. W. Prentiss, muscarine first produces increased excitability of the brain, and later reduced excitability, merging,

in cases of poisoning, into paralysis of the brain-cells. The action on the heart is similar to that upon the brain-centres: first, increased frequency, followed by slow, feeble pulse. The action upon man and the lower animals is identical. In the latter, poisoning by muscarine is followed by stoppage of the heart,—in relaxation or diastole due to paralysis of the inhibitory nerve. Application of muscarine to the heart-muscle produces the same effect. This condition is relieved and the heart again begins to beat upon the administration of atropine.

Experiments on animals poisoned by the fly-amanita and with pure muscarine show very clearly that when the heart has nearly ceased to beat it may be stimulated to strong action almost constantly by the use of atropine. In such cases of poisoning its use should be pushed as heroically as the symptoms of the case will warrant. V. K. Chestnut (Circ. No. 13, Division of Botany, U. S. Dept. of Agriculture, '98).

#### **Treatment of Muscarine Poisoning.**—

The patient should be kept in the recumbent position and as quiet as practicable, and the gastro-intestinal tract relieved at the earliest possible moment. The emetic to be employed should be selected so as to avoid depression, heart-failure being the chief danger, while the purgative should not be of a kind capable of encouraging, by the copious production of fluid, the absorption of the toxin. Thus, tartar emetic and salines become dangerous agents.

A tablespoonful of mustard in a tumblerful of lukewarm water usually acts promptly and may be administered if apomorphine is not at hand and while it is sent for. Unless copious emesis be obtained, the latter emetic ( $\frac{1}{16}$  grain) should be administered hypodermically. Sulphate of zinc is also effective.

As purgative, an oleaginous agent is to be preferred. Croton-oil, 1 drop, may





Fig. 11.—Fly-amanita (*Amanita muscaria*), top-view. Poisonous. Two-fifths natural size.

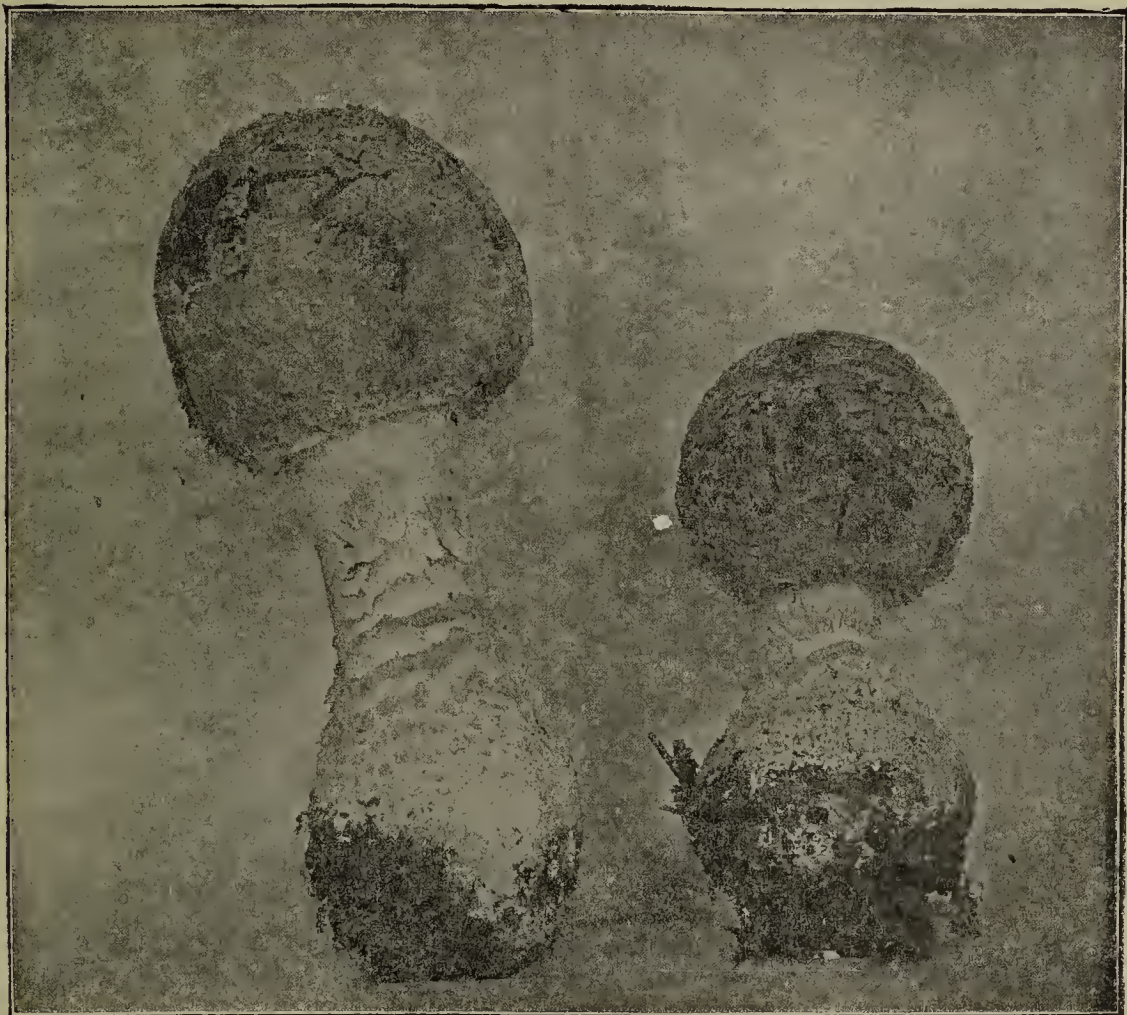


Fig. 12.—Fly-amanita (*Amanita muscaria*) buttons. Poisonous. Natural size.

be given, or if there is not much general torpor, a tablespoonful of castor-oil. Half an ounce of glycerin, in as much water, injected into the rectum sometimes produces a rapid evacuation.

Atropine being the physiological antidote of muscarine, it should be given at once hypodermically, the dose ranging from  $\frac{1}{120}$  grain to  $\frac{1}{60}$  grain, according to age. The pupil acts as a reliable guide if the case is not seen too late; the atropine causes dilatation of the pin-head pupil as soon as its physiological effects are produced.

To further sustain cardiac action, digitalis is given at fixed intervals, strychnine or nitroglycerin, and all the methods applicable in chloroform narcosis are indicated. The poisonous action reaches its crisis, then gradually recedes. The aim, therefore, should be to maintain life by sustaining the action of the heart throughout the dangerous period.

Strychnine used as an antidote in mushroom poisoning, twelve injections of  $\frac{1}{64}$  grain each causing complete recovery. Koenigsdorfer (Pharm. Zeit. f. Russland, No. 7, '94).

The physiological antidote of muscarine is atropine, which should be given in full dose, say  $\frac{1}{60}$  grain, and repeated if the pupils are not dilated by the first dose. With this should be given strychnine and such other stimulants and heart-tonics as are usual in the treatment of poisoning by depressants. Editorial (Northwestern Lancet, Jan. 1, '98).

First of all in importance is absolute rest in the recumbent posture; then the tincture of digitalis, 10 drops, should be given every two or three hours, according to the effect. If there should be blanched skin, pale face, and cold extremities, nitroglycerin,  $\frac{1}{60}$  grain, should be given hypodermically as frequently as required, instead of the digitalis. If the heart still continues weak and the vital powers are sinking, galvanism to the cardiac region and inhalations of oxygen may be employed. Efforts to keep the patient alive

should be unremitting; if the crisis can be tided over, nature will eliminate the poison and recovery be assured. For nourishment, concentrated foods are preferable, such as the meat-extracts, egg-albumin, milk, and the like. Nourishment is best given in small quantity at frequent intervals. D. W. Prentiss (Phila. Med. Jour., Sept. 24, '98).

#### Symptoms of Phalline Poisoning.—

Instead of acting on the heart as does muscarine, phalline—the toxic agent of the “death-cup”—tends to dissolve the blood-corpuscles, thus bringing about a condition simulating cholera. Severe cramps in the abdomen and lower limbs, particularly, come on a few hours after ingestion of the fungus. Violent diarrhoea, the stools becoming choleraic,—rice-water stools,—vomiting, algidity, collapse, cyanosis, muscular contraction, and convulsions sometimes follow one another in more or less rapid succession: a series of symptoms differing entirely from muscarine poisoning. The symptoms increase in intensity without the mental hebetude and torpor witnessed in the latter, though, when death is approached in from two to four days, increasing somnolence, due to carbonic-acid poisoning, may be witnessed. The prognosis is far less favorable than in muscarine poisoning.

#### Treatment of Phalline Poisoning.—

Unless free vomiting and diarrhoea have already relieved the stomach and intestines of what portion of the fungus may remain, the same precautionary measures in this particular should be resorted to as in muscarine poisoning.

Unfortunately, there is no known antidote for phalline, but, common salt acting as a solvent, intravenous injections of normal salt solution (7 parts of common salt to 1000 parts of water) might be tried. Transfusion of blood might also prove of value.

The patient is not out of danger for





Fig. 13.—Fly-amanita (*Amanita muscaria*), partly expanded. Poisonous. Three-fourths natural size.

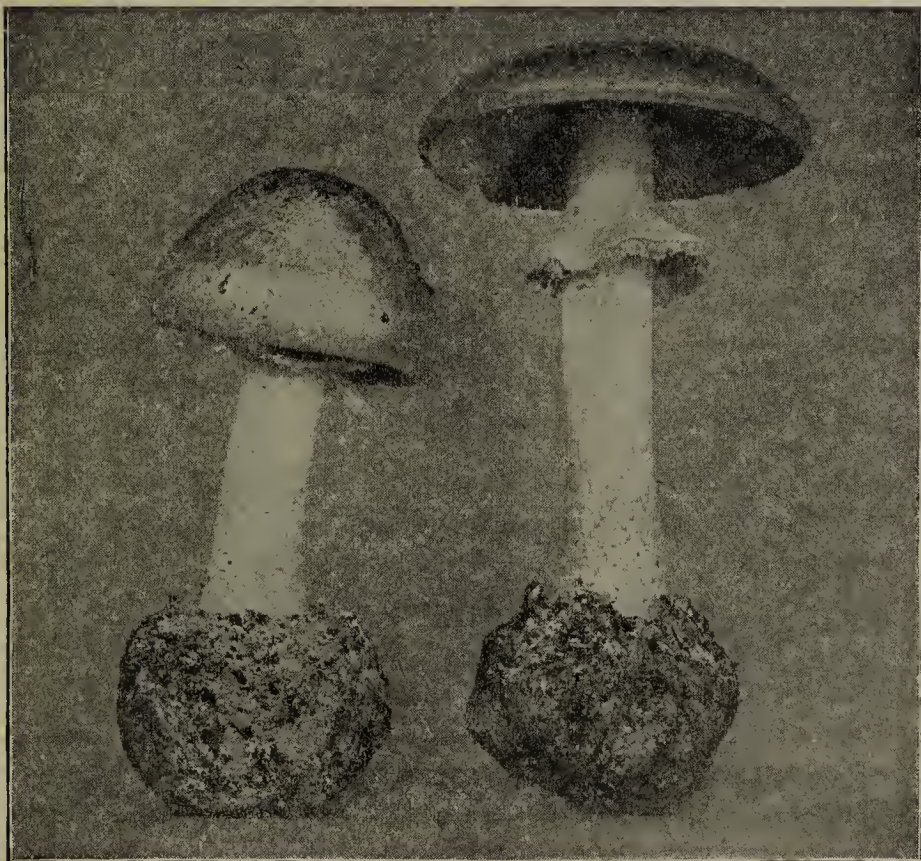


Fig. 14.—Death-cup (*Amanita phalloides*). Poisonous. Two-thirds natural size.

some days even after alleviation of the most active symptoms. He should, therefore, be closely watched and his strength sustained, as indicated under the previous heading.

If the amount of phalline already taken up by the system is not too large, it may wear itself out on the blood, and the patient may recover. It is suggested that this wearing-out process may be assisted by transfusing into the veins blood freshly taken from some warm-blooded animal. The depletion of the blood-serum might be remedied by similar transfusions of salt and warm water. Chestnut (Circ. No. 13, Division of Botany, U. S. Dept. of Agriculture, '98).

**TRACHEITIS.** See BRONCHITIS.

## TRACHEO-LARYNGEAL OPERATIONS.

**Thyrotomy.**—Thyrotomy is calculated to expose freely the interior of the larynx for the removal of foreign bodies and tumors. To admit air into the respiratory tract, however, in diphtheria, laryngeal œdema, etc., it is not satisfactory, as a rule, being too close to the lesion for the relief of which it is practiced. When a foreign body is impacted above the vocal cords and cannot be removed from above, it not only facilitates breathing, but also the removal of the offending mass. Tumors of the larynx, when situated within the larynx proper, are brought within easy access, and may be thoroughly scraped off.

The operation consists in a vertical incision through the skin in the median line and splitting of the thyroid cartilage underneath. Care should be taken to open the latter at the junction of the two alæ. A sharp and strong bistoury is required. In some cases the cartilage is ossified and a fine saw must be employed. The operation is comparatively bloodless.

There is always danger of impairing the voice, and it is advisable to close the wound as early as possible. Some operators, when the larynx has been cleared of tumors, and when air must be artificially admitted into the trachea, extend the incision, performing a laryngo-tracheotomy in addition to the thyrotomy, close up the thyroid wound, and insert the tube below.

**Laryngotomy.**—In case of emergency—*i.e.*, when through the presence of a foreign body, an injury, œdema, etc., air must artificially be admitted into the larynx—this operation is very satisfactory. It consists in an incision through the cricothyroid membrane, in the median line from the thyroid cartilage down to the first tracheal ring. After incising the skin and on reaching the cricothyroid membrane beneath, an artery—the cricothyroid—is met with; this should be pushed aside and the membrane incised perpendicularly. In doing this care should be taken to penetrate the tracheal mucous membrane, which tends to become detached and sacculated, thus blocking the trachea. A small tracheotomy-tube should be used, and removed as early as practicable, necrosis of the cricoid or thyroid cartilages being otherwise likely.

**Laryngo-tracheotomy.**—When in laryngotomy the operation is extended so as to include the cricoid cartilage and the first ring of the trachea—not lower, lest the isthmus of the thyroid body be encountered—the procedure becomes a *laryngo-tracheotomy*. When the patient is on the verge of asphyxia, technical nicety must sometimes be sacrificed to the urgency of the case. The trachea must immediately be opened whether hæmorrhage be feared or not, by a perpendicular incision in the skin and one a little shorter through the walls of the



trachea. If nothing but a pen-knife is at hand, this may be used when cleansed, and two hair-pins bent flatwise into letters S may be employed as hooks to keep the wound gaping while the patient's respiration becomes normal. Before incising the skin, however, it is always well to trace lightly, with a soft pencil, the site of the incision: *i.e.*, the middle line. If this precaution is neglected, the incision is almost always irregular; indeed, the knife may not enter the trachea at all, but suddenly plunge to one side of it. When the outline of the incision is drawn, the skin should be held firmly down in its proper place with the thumb and middle finger of the left hand, while the right does the cutting. The isthmus of the thyroid should be avoided if possible, but this is often difficult, owing to the short distance between it and the cricoid cartilage above.

**Tracheotomy.**—The various conditions in which this operation is indicated may be divided into three classes: 1. Those in which a morbid process suddenly or gradually reduces the laryngeal lumen and involves the probability of asphyxia, such as diphtheria, croup, œdema, paralysis, malignant disease, etc. 2. Those in which physiological rest tends to reduce the activity of the morbid process and delay its progress, such as laryngeal tuberculosis and syphilis. 3. Those in which an impacted foreign body cannot be removed through the glottis.

This operation, though apparently easy, is by no means so in the first class of cases mentioned, owing to rapid perpendicular motions of the trachea when violent efforts at respiration are made. In the second class there is, as a rule, no dyspnoea; hence the operation, in a thin subject especially, is less difficult, since the trachea is quiescent except when the patient swallows. The same may be said

of the majority of cases included under the third class.

It is not always possible to anæsthetize fully the patient when a stenotic disorder so compromises the respiration as to render expiration difficult, as is the case in tumors situated beneath the vocal cords; the residual air becomes so saturated with the anæsthetic that dangerous symptoms may appear if the agent used be pushed. A small amount of ether under such circumstances usually suffices to dull sensation, this being further assisted by the imperfect oxygenation occurring as a result of improper breathing.

The operation is performed as follows: The patient is placed on a table and the shoulders are raised on a pillow so as to cause extension of the neck. With a blue pencil, a line starting from the cricoid five to seven centimetres downward, exactly in median line, is drawn—the tracing for the incision. This should include the skin and platysma. Blood-vessels should now be watched for, and, if any are met with, they should be tied if at all important, or pushed aside if possible. Working down, cutting only on the grooved director, and strictly following the axis of the trachea, the rings are soon reached. If the vessels have received proper attention, the wound should be comparatively dry. The tenaculum is then used to steady the trachea, and, an assistant holding the lips of the wound apart with hooks, the three rings, including the cricoid, are cut, if need be. A violent inspiration then occurs, followed by the sudden expulsion of mucus, blood, or diphtheritic membrane if any be present: a dangerous feature for the surgeon if he is not on his guard. At this time, the patient often ceases to breathe for several seconds. Though he practically always recovers, the opening

should be carefully examined lest a mass of membrane, a plug of muco-pus, or a foreign body be the cause of the arrest of breathing. If it is prolonged, artificial breathing should be resorted to, or the patient should be slapped on the back and suspended by the heels. Finally, as a rule, the patient takes a deep breath and the respiration continues normal. The cannula is immediately introduced, the sponges being taken off at the same time. The flow of blood ceases almost immediately upon the restoration of the normal breathing; for prudence's sake, however, the patient should be raised and leaned forward, so as to cause what blood might ooze from the wound to flow externally, instead of in the trachea. When the operation has been satisfactorily performed, the external wound above and below the tube is closed by adhesive strips, taking care to approximate and adjust the edges accurately. The lower end of the wound should remain open for drainage.

Keen introduces a silk suture into the trachea on each side of the incision and through the skin, ties the ends, and leaves them hanging long. This provides a permanent retractor with which the surgeon can at any time open the trachea. If no tracheotomy-tube is at hand, an elastic band tied around the neck can be used to connect the free ends of the ligatures, and so keep the trachea patent for free respiration.

Silver-tubes are to be preferred when the instrument is to be worn a long time; aluminium tubes are the best when they are to be removed soon, since the metal is corroded by the secretions. The hard-rubber tubes are clumsy and become quickly saturated and foul. A double tube—the largest that can be easily accommodated—should always be employed. It should also be carefully tied

with tapes, around the neck, particularly in children.

During the operation, and as long as the patient is confined to his room, generally about a week, the atmosphere should be kept at a temperature of not less than 80° F., and maintained in a moist state by means of steam, obtained by boiling water in the apartment. In short, the object should be to furnish the lungs with air possessing as nearly as possible the properties it would possess if it were inhaled through the nose. To further attain this object, the foreign particles floating in the atmosphere can be arrested at the mouth of the cannula by straddling a piece of thin muslin over it; care should be taken, however, not to attach it so as to interfere with the free discharge of mucus. The best means is to tie a thin muslin handkerchief around the neck above the cannula, letting it overhang its orifice. This not only prevents the ingress of dust during inspiration, but also serves to prevent the regurgitation of mucus, which often takes place without such a contrivance, when a coughing-spell forces the discharges up to the mouth of the tube.

An important point is to keep the cannula as free as possible from the copious discharges which are formed for a couple of days after the operation. An intelligent attendant should be carefully instructed to withdraw the inner cannula every two hours, to cleanse it carefully with hot water, then to reintroduce it into the outer tube after having effectively freed the cavity of the latter of any mucus that might have accumulated there. This may be done by means of a feather, a piece of sponge, or absorbent cotton securely and tightly fastened to a suitably bent piece of thin, brass wire.

The patient should be provided with two complete cannulas so as to occasion-



ally be able to withdraw the outer tube also and cleanse it thoroughly. This can be done after a couple of days, the wound having had time to assume the shape of the outer cannula, thus enabling it to remain patulous for a short time after the instrument has been withdrawn complete. The extra cannula, previously warmed to avoid exciting cough, should be introduced immediately upon the withdrawal of the other, using, to assist its entrance, a Cohen pilot. This instrument, introduced into the outer cannula, presents a blunt-pointed knob which separates what tissues might impede the progress of the latter. It should, of course, be instantly withdrawn as soon as the tube is in position. The occasional (once or twice a week after the first few days) withdrawal of the tubes serves also to avoid what danger the corrosion of a metallic cannula might incur. Cases have been reported in which pieces of such a cannula, broken off at an eroded point, occasioned alarming symptoms.

Occasionally, granulations are formed at the external tracheal orifice, and in the trachea itself, the latter being especially the case when a fenestrated tube is employed. Strong astringent solutions sometimes suffice to destroy them; in some cases, however, surgical measures are necessary.

When the cannula is to be withdrawn permanently, the natural breathing powers of the patient should be tested by closing the aperture of the cannula with a stopper. If this is borne without difficulty, the instrument may be withdrawn, but kept within easy reach, with pilot in position, for sudden replacing if necessary. As a rule, however, this is not required, and the wound closes up after a few days to finally heal completely a week or two later.

The cannula has occasionally to be worn permanently, the patient, to speak, being obliged to place his finger upon the external opening. In this case, Luer's tracheotomy-tube, the inner cannula of which contains a silver pea, whose object is to arrest the expired current of air, so as to enable it to pass between the vocal bands, will be found very useful, rendering the use of the finger to close the tube unnecessary.

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### TREMORS.

**Paralysis Agitans (Parkinson's Disease).**

**Definition.**—An affection characterized by a special form of tremor, muscular rigidity, and attended with paralysis.

**Symptoms.**—The tremor of paralysis agitans possesses characteristics that are not observed in other forms. As a rule, it appears insidiously, though it may appear suddenly after a fright, a violent emotion, or a traumatism. It affects first the hand, the thumb, or the foot, but it is so slight that the patient hardly perceives it. It then disappears, and soon reappears with more or less increase in the area involved, and sometimes accompanied by hemiplegia and paraplegia. The peculiarity of the tremor is mainly due to the position assumed by the extremity affected. The fingers, for instance, assume the position required to hold a pen, the four straightened fingers united at their tips, tremble simultaneously, while the thumb oscillates rapidly and synchronously in their direction. These movements occur while the muscles are at rest, but cease when the patient is asleep. Under the influence of the will their intensity may be reduced to a certain extent. The arms, legs, feet, and head may take part in the tremor, although the motion of the

latter is mainly communicated to it by that of the extremities. Localized sweating is sometimes observed.

The muscular rigidity is a special feature of paralysis agitans. It begins by painful cramps which, though temporary at first, finally become permanent. Under the influence of this rigidity, the head, trunk, and the limbs assume special positions. The head may remain fixed in position, the eyes become fixed, and the features expressionless. As recently shown by Frenkel, there is a well-marked irregular thickening of the skin and a peculiar adherence to the subcutaneous tissues. This is especially marked over the forehead.

Later on, the muscular rigidity causes the thighs to become rapidly raised toward the abdomen, but there is no true contracture nor the epileptoid tremor of lateral sclerosis. The hands through muscular rigidity may become deformed. Besides the cramps already alluded to, the patient complains of a sensation of excessive heat, showing thermometrically an excess of 6° F. in some cases (Gowers). In some instances tremor is absent. Later on a peculiar paresis termed the "paralytic period" appears, the tremor becoming reduced in proportion, and the patient enters a cachectic period during which disorders of nutrition occur. He gradually sinks into a marasmus, with diarrhoea, anasarca, incontinence of urine, and gradual reduction of mental powers. An intercurrent affection, especially pneumonia, usually closes the scene (Dieulafoy).

Clinical study of 219 cases of paralysis agitans occurring in Dr. M. Allen Starr's clinic since 1888. There were 139 men and 80 women. The earliest case was in a male, aged 22 years; the latest in a male, aged 78 years. The largest number of cases, 40 per cent., began in the decade between 50 and 60

years. Occupation seemed to have no etiological bearing. Direct hereditary transmission can rarely be traced. In only 16 per cent. of the cases could paralysis agitans be found to have existed in relatives. Emotional influences were believed to have been the exciting cause in 40 of the cases. Next to emotion, traumatism seemed the most conspicuous predisposing factor, such a history being obtained in 31 cases. Other contributory causes given are certain acute infectious diseases, overwork, and alcoholism. Syphilis apparently played an unimportant part, and was admitted in only 2 cases. The writer states that the true etiology of the disease is not at all well understood.

Tremor was noted in 203 of the cases. The onset was seven times as frequent in the upper as in the lower extremity, and was more frequent on the right side of the body. In 3 cases it began in the head. It is usually lessened by voluntary motion. Muscular rigidity was present in 142 cases. Contractures were noted in 28 cases. In 173 instances the tendency of the patient to fall was tested. It was absent in 68 and present in 105 cases. The deep reflexes were investigated in 188 cases. Of these, 90 were normal; in 30 they were present but diminished; and in 68 they were more active than normal. There were definite voice changes of varying character noted in 120 cases. Pain in some part of the body was present in most of the cases. Paræsthesias were present in 120 cases also. These consisted usually of "prickling," "numbness," "tingling," "flushing," and "heat and cold." Hyperidrosis was present in 57 instances. The complications varied and could not be said to be dependent on the nervous disease. Two of the cases had hæmiplegia. Hart (Jour. Nerv. & Mental Dis., Mar., 1904).

**Etiology and Pathology.**—Although paralysis agitans is a disease of middle or advanced age, it is occasionally observed in young subjects and more frequently in males than females. Anxiety, worryment, violent emotions, exposure,



traumatism involving a nerve, infectious fevers, and heredity are recognized as causative factors. The exact nature of the morbid lesions is as yet unknown.

**Treatment.** — The bromides in large doses have been recommended, but their value is problematical. Far more useful are hot baths at a temperature of 122° F.; cold affusions on the head and applications of ice to the region of the fissure of Rolando; and galvanic or electrostatic baths. Subcutaneous injections of a 4-per-cent. solution of sodium phosphate diminish the Parkinsonian trembling, according to Liégeois. When the disease has evidently followed exposure to cold and wet, sodium salicylate or salol is recommended.

The drugs found of decided value in the palliative treatment of paralysis agitans are hyoscyne hydrobromate, duboisine sulphate, and hyoscyamine.

Hyoscyne hydrobromate is the most useful. Hyoscyne is a very powerful drug, and it is important to be very cautious with respect to the dose and mode of administration. It is best to give the drug by mouth in paralysis agitans. At first the dose should not be more than  $\frac{1}{150}$  grain. This may be increased up to  $\frac{1}{100}$  grain. If no toxic symptoms appear, such as marked dryness of the throat and dilated pupils, the dose may be cautiously increased. In paralysis agitans the dose may often be increased up to  $\frac{1}{75}$ ,  $\frac{1}{55}$ , or even  $\frac{1}{43}$  grain without bad effects, except dryness of the throat. But such large doses should only be given when the patient is in hospital, or can be very carefully and frequently watched. R. T. Williamson (Med. Chronicle, Feb., 1901).

### Tremor.

In an analysis of the pathogenesis of tremor based upon a study of the literature of the subject and clinical observation, Adamkiewicz (Berl. klin. Woch., Oct. 3, '98) reached the conclusion that tremor arose from disturbances in the

equilibrium of the two spinal innervating stimuli. Two currents pass along the spinal cord to the ganglion-cells of the anterior horns from which the nerves for the muscles arise. One of these currents passes along the posterior columns, the other along the pyramidal tracts. The former arises in the cerebellum and keeps the muscles in a state of tension; the other originates in the cerebral cortex and conveys voluntary impulses to the muscles. When both currents are properly balanced, they act upon the muscles as a stimulus and as a check like whip and rein. If the excitation along the posterior columns is insufficient the muscles deprived of their check become unruly and produce ataxia. When, on the other hand, the muscles are controlled by the current along the posterior columns and the regulating action of the pyramidal tracts is absent, as, for example, in lateral sclerosis, the muscles of the lower extremities are in a state of excessive tension; so that the joints become immovable and the gait stiff, labored, and dragging. If the patient attempts to move, the hypertensioned muscles develop a state of tremor. In the beginning this tremor is slight, but in proportion as the tension of the muscles increases it becomes augmented, until finally a tremor-paroxysm develops. Various toxics,—lead, tobacco, opium, coffee, tea, cocaine, hasheesh, arsenic, etc.,—hysteria, and old age are the main etiological factors in tremor. Dana has observed a family in which it was distinctly hereditary.

**TOXIC TREMOR.**—This is a form of trembling due to the toxic influence of mercury, lead, copper, and arsenic, that induced by the latter drug being especially tenacious. Tobacco often induces tremor in elderly men.

**Treatment.** — In tremors due to the

first three metals Liégeois recommends potassium bromide, 150 grains daily, during one month. It forms with the metal a soluble bromide which is easily voided by the urine. In arsenical tremor frictions and baths are alone effective.

**ALCOHOLIC TREMOR.**—The inability of the hands to hold anything, the paresis of the legs, with a dragging gait, the arrest of the tendinous reflexes, and the trembling which are seen in alcoholics, should be classed, according to Liégeois, with the trembling of paralysis.

**Treatment.**—Strychnine alone is not so efficacious as when it is associated with picrotoxin and with veratrine. Ten galvanic or electric baths give successful results in tremor potatorum. For this acute stage of chronic alcoholism, which is called delirium tremens, alcohol in doses of from 2 to 3 ounces is an excellent remedy. It induces sleep immediately and the patient awakens cured. (See **ALCOHOLISM**, volume i.)

**SENILE TREMOR.**—This form seldom appears before the age of seventy years, and is especially marked in the upper extremities, the hands in particular. In some cases the head also takes part, and transmits, by its rapid movements, rapid oscillations to the entire body. The movements are especially marked during muscular activity.

Nothing seems to give better results, according to Liégeois, for senile trembling of the limbs accompanied with a transverse or vertical tossing of the head, than an analeptic diet and river-bathing, if there are no contra-indications; an infusion of the flowering heads of *Chenopodium ambrosioides* may also be given in the proportion of from 2 to 2½ drachms to a pint of water.

**TROPICAL FEVERS.** See **SPECIFIC INFECTIOUS FEVERS.**

## TUBERCULOSIS OF THE LARYNX.

**Definition.**—A tuberculous, primary or secondary, infiltration of the glandular elements and connective tissue of the larynx characterized by tumefaction and ulceration and giving rise to dysphagia, aphonia, and dyspnoea.

**Symptoms.**—Tuberculosis of the larynx is often present in cases of pulmonary tuberculosis, and, were all the latter systematically examined laryngoscopically, lesions, so situated as to preclude active subjective symptoms, would be found in the majority of cases. Unless marked hoarseness, aphonia, or local pain be complained of, the larynx receives but little attention; were it otherwise, a greater degree of comfort could be afforded consumptives than they obtain when the pulmonary disorder is alone treated.

The larynx may become infected either through the lymphatics or directly through invasion of the laryngeal tissues proper by the bacillus of tuberculosis. Whether an erosion is necessary or not in the latter case is not established; it is believed, however, that such an erosion is necessary.

Slight hoarseness, short periods of aphonia,—a couple of seconds' duration at times,—a sensation of dryness, and local heat represent the early symptoms generally met with. If there is a pulmonary trouble, the symptoms of the latter, especially the cough, cause the laryngeal trouble to be attributed to it. After a period varying in length, the local pain is increased by deglutition, and sometimes radiates to the ears. The hoarseness is now apt to become aggravated or the voice may be completely lost.

Cough is not severe, as a rule; but it is peculiar, being usually husky and lacking in resonance. The general



health may continue to be good as far as active constitutional symptoms are concerned, until the distress during deglutition becomes such as to cause the patient to reduce the amount of food he takes to avoid the pain the act involves. Indeed, the dysphagia is such sometimes as to render the taking of any food a source of dread to the patient, and constitutes the most marked of all the symptoms. It is especially severe when the epiglottis is the seat of the tuberculous ulceration or when the pharynx is affected. In fatal cases it is apt to persist and to become steadily aggravated. The pulse, temperature, and other general symptoms are those of pulmonary phthisis, but emaciation progresses more rapidly than in the latter disease, the pain during deglutition causing the patient to abstain from food as much as possible.

Examination of the larynx during the early stages usually reveals a characteristic feature: a pale-yellowish tinge, which sometimes reaches to absolute pallor. In the majority of cases a typical sign also appears: a pyriform swelling, or "clubbing," of the arytenoids, which causes these prominences to resemble small cushions if they are both enlarged, which is not always the case. In some instances, however, the larynx may be as red as usual, and even appear congested. After a short time, grayish superficial erosions may be detected, which, after awhile, become deeper and sharp-edged, and are surrounded by a narrow, red areola. A thick, tenacious secretion usually collects over them which can only be removed with difficulty. The morbid process then extends in various directions until almost any part of the larynx and neighboring tissue is involved in the general trouble. Various excrescences or tumors may appear, so

situated, sometimes, as to compromise the laryngeal aperture.

Hypertrophic or hyperplastic tuberculosis of the larynx must be considered a distinct and unusual form of the disease. As a rule, there is no ulceration. Ulceration may be present at the same time as the hyperplasia of the tissues in some part of the larynx, but the characteristic circumscribed hypertrophies and tumor formations do not break down. It is practically always secondary to the pulmonary involvement, but there appears to be some evidence in support of the statement that particularly this form of tuberculosis may at times be primary. C. F. Theisen (*American Journal Medical Sciences*, Nov., 1903).

**Diagnosis.**—The pallor of the mucous membrane, especially marked posteriorly, the club-shaped masses over the cartilages of Wrisberg and Santorini, and, in a large proportion of cases, the turban-like epiglottis give the larynx a characteristic appearance when the local process is at all active. The ulcers are more superficial than those of a syphilitic larynx, and appear grayish rather than yellow, as is the latter disease. The syphilitic ulcer is "punched out," with perpendicular and crenelated edges, and the areola is dark in hue. The cancerous ulcer tends to be raised by underlying accumulation of morbid elements, and is totally devoid of the pallor peculiar to tuberculosis. The pain is usually most acute during deglutition in tuberculosis, during phonation in syphilis, and constant in cancer.

**Prognosis.**—Spontaneous cure of the slight tubercular ulcers occasionally occurs (14 cases out of 3000, Heryng), but the normal tendency of a tubercular process in the larynx is toward aggravation. When the epiglottis is affected the chances of recovery are very slight. These are improved materially, however,

if the patient can be removed to a mild and warm climate and when the general health can, by suitable dietetic means, out-of-door life, and the judicious use of creasote, be favorably influenced.

**Treatment.**—The treatment of tuberculosis of the larynx should be local and general. The indications for the general measures will be thoroughly reviewed in the next article, and are *invariably* applicable when the larynx is diseased, whether primarily or secondarily.

Thorough cleansing of the laryngeal surfaces is an important feature of the treatment. This can be done most satisfactorily with a lukewarm solution of borate of sodium and bicarbonate of sodium, 10 grains of each to the ounce of water, using an atomizer, or the familiar Dobell's solution. Care should be taken to relieve the surfaces of all purulent discharges, and thus prepare them for remedial agents. If this cannot be done daily by the attending physician, some person in the immediate surroundings of the patient should be carefully instructed; but under such circumstances the cleansing process had better be resorted to night and morning. As a local application Elsberg's saturated solution of iodoform in ether has stood the test of time; it must be applied with the laryngeal forceps, a cotton wad being used. For the patient's home use, a solution of menthol, 20 grains to the ounce of benzoinol,—an excellent agent for the purpose,—will not only relieve the suffering, but greatly assist the curative process.

More active measures are resorted to by specialists, and lactic acid may be said to hold the first position in this direction. A 50-per-cent. solution, well rubbed into the ulcerated tissues after they have been thoroughly anæsthetized with a 20-per-cent. solution of cocaine

every three days, is often productive of excellent results, but only in cases in which the local lesion is limited in extent. This treatment is greatly facilitated by the continued use of orthoform either in powder or, as advised by Kassel (*Ther. Monats.*, No. 10, '98), in the form of an emulsion containing orthoform, 25 parts; olive-oil, 100 parts. The burning sensation lasts only about a quarter of an hour, and is then succeeded by anæsthesia, which commonly lasts from twenty-four hours to three and a half days. The patient is able to eat all kinds of food, and the appetite is greatly increased. A distinct diminution in the amount of secretion in cases of ulceration is noted, but otherwise it does not appear to have any local therapeutic value. Patients do not dread the lactic-acid treatment if orthoform emulsion is used regularly.

Observations extending over a period of three to nine months, on the hypodermic administration on alternate days, in 10-minim doses gradually increased to 20, of antitubercle horse-serum prepared at the Biochemical Laboratory, Washington, D. C., for the United States Government, show of laryngeal ulcerations healed, 8 cases; laryngeal ulcerations improved, 2 cases; laryngeal ulcerations unimproved, 2 cases; laryngeal thickenings improved, 7 cases. Subjective symptoms also showed marked improvement, the voice returning, cough subsiding, and pain ameliorating. Walter F. Chappell (*N. Y. Med. Jour.*, Sept. 10, '98).

In phthisical laryngitis, by insufflating a small quantity of orthoform in the throat, the patient is able to take food in comparative comfort for two days after each application. William Cheatham (*Amer. Therap.*, Feb., '99).

The curette may be used to advantage when too much tissue is not involved in the tuberculous process. It should be limited, however, to primary and incipient cases, and to cases in which the pul-



monary lesions are very limited in area. Under such circumstances the chances of success are quite fair. Unfortunately the procedure requires a degree of dexterity which an experienced specialist alone can possess, even with the assistance of a 20-per-cent. solution of cocaine, which facilitates the operation and renders it comparatively painless. Heryng's or Krause's curette may be used, the operation being watched in the laryngoscopical mirror. Cicatrization is usually complete in three or four weeks, and considerable relief is afforded if cure is not obtained. The application of a 50-per-cent. lactic acid to the curetted spot serves to increase the efficiency of the treatment. Unless it can be carried out thoroughly, however, it had better not be resorted to.

Among the more severe surgical measures at the disposal of the physician, enucleation of the diseased area with sharp forceps may be advantageous when the infiltration is limited to a location, such as the arytenoid prominences, which may readily be grasped. Thyrotomy enables the surgeon to reach all parts of the larynx from the outside and to curette thoroughly any diseased surface. This should not be resorted to, however, when the disease is far advanced. Tracheotomy is sometimes resorted to, to give complete rest to the larynx or when dyspnoea becomes a source of suffering or threatens to become aggravated.

An important feature of the treatment is to enable the patient to nourish himself properly. Unfortunately the dysphagia is always the most marked symptom, and the sufferings of the patient are sometimes excruciating. The most satisfactory method is to apply a 4-per-cent. cocaine solution with the atomizer about 5 minutes before each meal, to the

larynx, thoroughly bathing all its surfaces, and to alternate this every week with orthoform powder. The patient does not, in this manner, become habituated to either drug, and the beneficial effects of each are preserved.

Much of the suffering may be avoided in the later stages if, as suggested by Wolfenden, the patient will lie on his stomach on a bed and suck up liquid food through a tube from a receptacle placed on the floor. The food thus tends to enter the œsophagus through the pyriform sinuses on each side of the larynx, and to avoid contact with the latter.

Formaldehyde is an excellent remedy in tubercular laryngitis. The treatment is begun with solutions of from  $\frac{1}{2}$  to 1 per cent., and gradually increased until a strength of 10 per cent. is applied. When strong solutions are used the larynx should be cocainized before their application. Weak solutions of a single drop of liquid formaldehyde in an ounce of water have an anæsthetic power that produces exceedingly gratifying results when used as a gargle or spray in advanced cases, where swallowing is painful. The use of such solutions enables the patient to avoid the discomfort and the use of cocaine. T. J. Gallagher (Jour. Amer. Med. Assoc., xxxii, p. 476, '99).

Phenosalyl, composed as follows, highly recommended:—

R Carbolic acid, 9 parts.  
Salicylic acid, 1 part.  
Lactic acid, 2 parts.  
Menthol,  $\frac{1}{10}$  part.

Used in sixteen cases, always applying a local anæsthetic first. Dysphagia soon became improved, dry tuberculous ulcers without œdema and infiltration became clean after a few treatments, and the larynx assumed a rosy-red color. Stanislaus von Stein (Klinisch-therap. Woch., Oct. 28, 1900).

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### TUBERCULOSIS OF THE LUNGS.

**Definition.** — Pulmonary tuberculosis, phthisis, or consumption, is a specific inflammation of pulmonary tissue caused by the inception of the tubercle bacillus. Small nodules are scattered, more or less profusely, throughout the diseased areas, and cause certain pathological changes, such as infiltration, caseation, fibrosis, calcification, and ulceration.

There are three stages of this disease which may be recognized either pathologically or clinically, viz.: incipient, moderately advanced, and far advanced. There are also two varieties: the acute and chronic.

**Etiology.**—Prior to 1882 this disease was supposed to be hereditary, and little was known of its contagious character. In that year Koch revolutionized the accepted views of its etiology by demonstrating the tubercle bacillus. This bacillus is one of the most prevalent of the known infectious germs. It attacks mostly the warm-blooded animals, being a common invader of fowls, pigs, cows, and other domestic animals; the horse is only slightly susceptible to infection. Some warm-blooded animals, notably the guinea-pig, while comparatively immune to infection, are very susceptible to inoculation.

Among the human race the disease is very easily contracted, and is the most wide-spread and fatal one to which man is heir. Its ravages are especially apparent in large cities and towns.

Longitude and latitude have but slight influence upon its prevalence, but altitude seems to exert a more or less controlling influence upon the life of the germ. Foul air, overcrowding, lack of sunshine, dampness, combined with low altitude and unsanitary conditions generally, are all potent factors in the propagation of the disease. Direct conta-

gion from kissing is possible, and the inception of the germ may possibly occur through using the same eating and drinking utensils without careful sterilization.

Infection by tuberculous meat eaten in a partially raw condition has been frequently demonstrated, as well as the danger of infection by tainted milk. The latter is not an infrequent source of infection, and by many observers is accountable for the prevalence of intestinal and mesenteric tuberculosis in children.

Primary tuberculosis in a very large majority of cases begins in the lungs, and it is assumed that such cases are due to the inhalation of the bacillus in dried sputum in the form of dust. It is claimed by some writers that prolonged exposure to the exhalations of tuberculars in close rooms, as in crowded tenements, is often followed by the development of the disease. However, before this can be satisfactorily demonstrated, the very potent concomitants of unsanitary environment, constitutional dyscrasia, and the lack of care in the disposal of infected sputa must be eliminated. After the crusade of 1896-97, inaugurated by the New York Health Board, it was shown that secondary cases in given tenements or flats occurred *in exact proportion to the intelligence and honesty displayed by the occupants in carrying out the prescribed rules for the disposal of sputa.*

The bacillus may also be transmitted by a tubercular coughing directly at the face of a healthy person. Another method of transmitting the germ is the use of the "sanitary spit-cloths," which are subsequently burned with the secretions which remain on them, no notice being taken of the pockets and the clothes constantly smeared by the mis-



named sanitary cloths wet with infected sputa.

Heredity as a causal factor of pulmonary tuberculosis is to be noted only as a predisposing physical deformity which is inherited. This departure from the normal may be noted in a general lack of resisting power to disease, especially a proneness to attacks of bronchitis; strumous conditions during childhood; abnormally narrow chests in a flat thorax and lack of expansion of the upper lobes of the lungs. A very significant indication of predisposition to pulmonary tuberculosis is a constantly present tachycardia. Certain forms of anæmia are also etiological factors in the inception of this disease; poor food and prolonged lactation; employment in certain trades, such as knife-grinding and polishing; silk works, and mines are also to be noted among the general sources of pulmonary tuberculosis. Among other immediately predisposing factors may be mentioned pneumonia, influenza, bronchitis, pleurisy, syphilis, diabetes, and scarlatina.

Other methods of infection are by direct inoculation, such as occurs in experimental work upon guinea-pigs, and accidentally in those who handle tubercular meat or infected tissues; in post-mortem work, the verruca necrogenica, a local tubercular process, is commonly seen upon the hands of those preparing autopsies and close contact, such as occurs between man and wife. In the performance of the rite of circumcision there is a well-known instance of direct inoculability, where a diseased operator communicated tuberculosis to several infants by the practice of suction. Wherever infective material comes in contact with an abraded surface or where tissues are directly exposed to its action, local infection may occur. This is com-

monly seen in the tubercular nature of the lining membrane of sinuses and tracts leading from foci.

One of the most common predisposing factors to the successful inroads of the tubercle bacillus in the lung is a diseased condition of the upper air-passages. Perhaps the most powerful of these is bad nasal ventilation, such as may be caused by adenomata, nasal spurs, etc., which induce the patient to breathe through the mouth.

A probably frequent focus of tubercular infection is the ring of lymphoid tissue which surrounds the naso-pharynx: the cross-roads where the food and air may pass each other. So far as the faucial tonsils are concerned, infection could, of course, take place either from organisms deposited there (in mouth-breathers) by ingested food or by inspired air. In the naso-pharynx it can only be on rare occasions that infected food can contaminate the "third" tonsil. It is concluded that the commonest mode of tubercular infection is by inhalation, and that the inhaled bacillus has infected the system *before* the air-current has reached the larynx—most probably through the lymphoid tissue of the naso-pharynx. There appears to be no justification for the generally accepted idea that the bacillus is inhaled directly into the pulmonary alveoli. St. Clair Thomson (Practitioner, July, 1901).

Finally, it is to be noted that, while the bacillus of Koch is the specific agent necessary for the development of pulmonary tuberculosis, one or more of the general and direct predisposing causes before mentioned must have prepared a suitable soil for the bacillus to become inimical to the patient.

Hereditary tuberculosis is seen only in infants or very young children, and its methods of transmission, presumably *in utero*, will be considered later.

BACTERIOLOGY.—The etiological factor of tuberculosis, the bacillus of Koch, is a non-motile, parasitic aërobic and

facultative aërobic rod-shaped organism two to four microns in length, or about half that of a red blood-corpuscle, and two-tenths micron in diameter, having—as one of its most characteristic features which distinguishes it from all other bacteria known, with the exception of the bacillus of leprosy which it closely resembles—the ability to retain the stain of the alkaline solutions of the aniline dyes after treatment with acids. This bacillus is found in all tubercular lesions, and shows a marked tendency to arrange itself in V-shaped pairs. It is frequently bent or slightly curved, and presents, when stained, small, rounded, or oval, clear, bright spaces,—three, four, or five to each bacillus,—which, failing to take the stain, give it the appearance of the streptococcus.

It fulfills Koch's circuit: it is found in this and in no other disease. It is capable of cultivation outside the body and of producing, when inoculations are made from these cultures, the original disease, in the lesion of which is found the bacillus. This circuit can be indefinitely prolonged, and the inoculation carried on through a series of animals always resulting in the production of tuberculosis.

It grows upon a variety of culture-media, such as bouillon, potato, and agar to which glycerin has been added, and at a temperature of about 37° C.; best upon blood-serum at a temperature of blood-heat in the presence of moisture and small quantities of oxygen and in the absence of sunlight: conditions highly available in the living tissues of all mammalia, to which the disease usually restricts itself. On artificial media its growth is slow; about the beginning of the third week may be seen on the surface a thin, grayish-white layer, which fails to penetrate into its

depth. It elaborates a toxin which is soluble in glycerin, and which produces, when injected into tubercular animals, a reaction accompanied by temperature; in healthy animals no such effect is obtained, and in consequence it becomes of diagnostic value.

In two hundred consecutive specimens of sputa examined bacteriologically, tubercle bacilli were detected in 50 per cent. In early stages of phthisis and in the acute disseminated variety, tubercle bacilli may not be present in the expectoration, there being as yet no breaking down in the lung. Students often fail because they prepare too few specimens, and examine these too superficially.

It is impossible to gauge the severity of the disease by the number of bacilli in a given specimen; but, on the other hand, if the patient's sputum be systematically examined at definite periods during the illness, the progress toward recovery will be seen to be marked by a steady diminution of the tubercle bacilli.

In the examination of serous fluids, pus, or sections of tissues, the margin of error is very great if reliance be placed on negative results. A positive result is conclusive; but this can seldom be arrived at without inoculation experiments. Even if inoculation be resorted to, the possibility of error is not eliminated, for the quantity of centrifugalized material inoculated into a guinea-pig is very small.

In actual practice the only bacillus which is likely to be mistaken for the tubercle bacillus is the smegma bacillus, and this has recently been shown to have a wider distribution than was formerly thought. For this reason the examination of urine for tubercle organisms is useless unless the water be drawn off with aseptic precautions, and unless the films be (subsequent to decolorization with acid) allowed to soak in alcohol for at least thirty minutes. J. O. Symes (Brit. Med. Jour., Feb. 23, 1901).

Patients may react to tuberculin and no evidence of tuberculosis be found at



autopsy. The writer's six cases seem to demonstrate that completely healed tuberculosis may react. Cases of proved tuberculosis may not react to the maximum doses. The evidence is not conclusive that other diseases than tuberculosis may react to tuberculin. The margin of error of the tuberculin test is considerable, and probably not less than 10 per cent. The maximum dose should be higher than 4 milligrammes, and not more than 10 milligrammes. Small increasing doses are not advisable, as the reaction is not so likely to be distinct on account of the tolerance which may be produced. An initial dose of 3 to 5 milligrammes, followed by the maximum dose, is better. The temperature should usually be normal before injections are given. When the temperature is distinctly above normal a negative result is of no value, as these patients will frequently not respond at all, even to large doses. It seems quite certain that the glycerin extract of tuberculin deteriorates, and a fresh bottle should frequently be opened, care being taken to keep it in a cool, dark place. The 0.5-per-cent. carbolic acid solution should be made up on the day it is used if possible. The author believes that deterioration of tuberculin is the principal factor in producing delayed reactions. It cannot be said that tuberculin injections are entirely without ill effects, but their use among suitable patients is no more dangerous than the use of chloroform and ether for diagnostic purposes, and is quite as justifiable as an early diagnosis of tuberculosis is of the greatest importance. Madison (*Amer. Med.*, Dec. 20, 1902).

The germ of tuberculosis is ubiquitous; few persons reach maturity without infection; none reach old age without a focus somewhere. If the ravages of the disease are not greater than they are, it is due to the great resistance of the human body to the disease and to any lack of exposure to its germs. Ninety-eight per cent. of all cases of tuberculosis must be treated in the home. It is, therefore, of transcendent importance that the profession and the public should have clear ideas as to the home treatment of the disease. The

points of chief importance are: Early diagnosis. Too often is precious time wasted and the golden opportunity allowed to slip by the failure of the physician properly to examine the chest. Early cases should be managed in a more masterful way. It is the author's firm opinion that more patients are injured than benefited by drugs. It is not that the drugs themselves do so much harm, but that weeks are lost in trying to check a cough or control a fever in a patient who is allowed to continue his work and be up and about. The rational treatment of tuberculosis, and the only one that will give good results, resolves itself into seeing that the patient is kept under control from the first stages of the disease and that he receives plenty of good food and fresh air and absolute rest during the febrile periods. William Osler (*Medical News*, Dec. 12, 1903).

Number of bacilli in any specimen of sputum means little; it is common to see, in incipient cases, the microscopical field crowded, and these very cases fail to show at the time or in their subsequent history either clinically or by physical examination, any evidence of an active process. We believe that, to some extent, this is accounted for by the ability of the germ to multiply in the retained secretions, and that, so far as number is concerned, we are oftentimes observing the saprophytic tubercle bacillus which has germinated and passed its life-cycle in these secretions, instead of the invading bacillus which has made an inroad upon living lung-tissue and has been cast off. And in the same way, to some extent, the well-known clinical fact that bacilli are more apt to be found in the morning sputum than that occurring later in the day, is accounted for.

**BACILLUS EXTERNAL TO LIVING TISSUES.**—External to living tissues the conditions for the growth of the bacillus are extremely unfavorable: after an exposure to sunlight of from a few minutes

to several hours, or to diffused daylight from five to seven days, its growth is retarded, its virulence modified, and it is usually destroyed. Direct sunlight is particularly fatal to this germ, and it is in this that we have the explanation of the partial protection against the wholesale infection of rooms and localities frequented by phthisical patients; while the dust in the room of a tubercular individual may contain the germ and be capable of carrying the infection, the bacillus under such conditions remains in an inactive state, does not multiply, and gradually loses its virulence, but only awaits, during its slow destruction, a proper soil upon which to alight, and this not infrequently comes with the susceptible individual who cares for the sick and is constantly breathing a germ-carrying atmosphere. Dry sputum may retain for months its infectivity, but, as a rule, this is destroyed by its exposure to sunlight, and the disinfecting process is usually complete before the sputum has become sufficiently dried and pulverized to be air-borne.

**HEREDITY.**—There is no fact to substantiate the theory of direct transmission from the male through a germ-carrying spermatozoön. There is, however, experimental proof in animals that the female ovum may be the carrier, but whether this ever takes place in the human being is a question, and from a practical point may be cast aside.

Congenital tuberculosis, in the majority of instances, occurs from infection through the blood-current; either the bacilli lodge and grow in the placenta or, having passed this tissue, invade the foetal organs and blood; but, considering the prevalence of the disease, congenital tuberculosis may be regarded as one of the rarities in medicine. Children born

of mothers who at the time of conception are far advanced in the tubercular process, seldom show at birth any sign of the disease, and inoculations of the foetal tissues into rabbits give negative results.

The commonly-accepted belief of the laity is that the children of tubercular parents inherit directly from them the disease which, harbored for many years in a latent state, under suitable conditions becomes manifest. Heredity, in the vast majority of instances, means nothing more than the transmission from parent to offspring of tissue peculiarities, in accordance with that invariable tendency throughout the vegetable and animal kingdoms for each individual to exactly reproduce itself, not only in its form, size, function, and in its nature, but in its reaction to environment and in its ability to withstand or to be overcome by the action of various poisons and disease-producing germs; and this is true, not alone of individuals, but of organ and of cell; and it is this susceptibility of cell to invasion by the bacillus of tuberculosis, and not the disease itself, which has been inherited, just as children have the blue eyes of their mother or the black hair of their father, or the mental traits and physiognomy of either, which stamp them as a family, brothers and sisters of a common flesh and blood. The old expression that the patient has inherited "weak lungs" covers the ground, and with the proper soil which, under the influence of our civilized life, is kept tilled by the depressing influences of bad food, poor ventilation, and the like; these, with the wide distribution and prevalence of the germ, give at some time all susceptible individuals their opportunity to become infected, and, alas, how many take the chance!



**INFECTION BY THE RESPIRATORY TRACT.**—This is by far the most common route of infection, and to appreciate the polluted atmosphere that we ordinarily breathe it is only necessary to watch the dust in the path of a sunbeam admitted through a slit into a dark room. Add to this the countless numbers of bacilli cast off in the expectorations of phthisical patients, and the negligence ordinarily observed in the care of sputum, and the explanation of the high mortality of this disease among the inmates and attendants of the large charity institutions of our cities is easily accounted for. The great source of danger is from pulverized sputum in the form of dust; and to prove this there is the fact that in the well-directed sanitariums of this country and Europe, where scrupulous scientific cleanliness is observed and particular attention is paid to the disinfection of sputum, infection of nurses or attendants, or those coming in intimate contact with the sick, is an extremely rare occurrence. It goes to show what degree of prophylaxis can be secured by intelligent handling. This is one of the great arguments in favor of sanitariums.

**RACE:** Among all the aboriginal peoples, when suddenly ushered into the midst of artificial life consequent upon civilization,—and the same may be said of animals which the ingenuity of man has succeeded in bringing into captivity,—the disease is terribly fatal; one has but to look upon the record the Indian has left behind him, or to go down among the slums of the great cities, and see its ravages upon the negro race; or to visit the menageries and ask “What limits the captivity of animals?” to see the vast destruction of this disease. In each instance it is the Great White Plague which stares him in the face: a

veritable barrier to a sudden transition from a non-civilized into a civilized environment. So fatal is it to the black man of this country when living under the influence of city life that we believe this disease will play no little part in the solution of the race problem which confronts us.

**Morbid Anatomy and Pathology.**—Scattered throughout an infected area are found small, non-vascular, cellular masses—tubercles of different sizes, the result of tissue reaction upon the invading bacilli and their toxins. The tubercles are composed of various cellular elements and tubercle bacilli, the former being derived from multiplication of the fixed connective-tissue cells of the part, from the endothelium of the blood-vessels, and from leucocytes which have migrated in large numbers to the point of attack. There is sometimes seen in the centre of a tubercle an immense cell—the giant cell which frequently contains bacilli; its increased size is supposed to be due to an abortive effort at reproduction with resulting increase in size, owing to its failure of division.

In the alveoli of the lungs and the bronchial cavities of rabbits tubercles develop exclusively at the expense of the leucocytes, especially those large mononuclear cells which arrive quickly at each focus of infection. They therefore contend that the fixed cells of the alveoli and the epithelial cells of the bronchial walls play absolutely no rôle in the histogenesis of the tubercles. Morel and Daloux (*Archives de Méd. Exper.*, Mar., 1901).

As a result of nutritional failure, the centre of this mass which is farthest removed from nourishment, the whole being a tissue of a low degree of vitality, undergoes coagulation-necrosis; subsequent softening may occur, with breaking down; or the liquid portion may be

absorbed and leave a caseous mass, which, in turn, may become impregnated with lime-salts giving a calcareous deposit, while the whole may be capsulated in a fibrous protecting envelope that the tissue-cells have thrown out to surround the focus of infection, thus making of it a foreign body (*see colored plate*). Should softening and ulceration into a bronchus take place, a cavity is formed, its size depending upon the extent of structure invaded. From the absorption of the toxins, the adjacent tissues to a tubercular process undergo inflammatory changes to greater or less degree, and in the lungs of phthisical patients broncho-pneumonic areas are commonly found surrounding foci of infection.

As might be expected in a disease which may be either acute or chronic, localized or diffusely infiltrated throughout a tissue, the morbid anatomy presents a diversity of lesions, but underlying these varied conditions there is but one and the same pathological process. These naked-eye differences are dependent largely upon mechanical or physical conditions; upon location; the tissues involved; the rapidity of the process; the degree to which the tissue-cells have been able to throw out their protective barriers of fibrous tissue; and the subsequent behavior of that fibrous tissue, whether it contracts, which is its natural tendency, with resulting distortion or puckering of lung, or, if localized, with the formation of a scar or the obliteration of a bronchus, producing dilatations, or bronchiectasy; or whether it becomes diffuse throughout a lung or lobe, giving the picture of fibroid phthisis. Thus a tubercular cavity and a tubercular ulcer are one and the same thing, their only difference being in contour, and they both represent a tuber-

cular nodule in its later stage, minus its broken-down and softened centre. The ulcer may be considered a cavity divided in half.

A consolidation is merely an aggregation of tubercles, or the tubercular process in which all the tissue of that area is involved with little or no normal structure sandwiched in between.

If these minute tubercular masses become scattered throughout the lung so that normal tissue-elements intervene, the picture of an infiltration presents itself. When the disease progresses, with consequent diminution of the normal adjacent structure, the process is spoken of as passing from the stage of infiltration to that of consolidation. The pathological change is practically the same, the chief difference depending upon the amount of tissue involved, and whether the process be diffused or localized. True consolidation is considered a later stage of infiltration, because it is a degree nearer to the breaking-down process; but the chief reason for this breaking down is that the mere aggregation of these tubercles, these non-vascular, cellular bodies of low vitality, cuts off nutrition from the interior of its own mass, in consequence of which softening takes place. An infiltration shows no such tendency, because nourishment is derived from the intervening normal elements, sufficient to keep the area from undergoing destructive changes. The broncho-pneumonia of acute or galloping consumption may be considered a tubercular invasion similar to the rest, but lacking the picture of more definite arrangement into tubercles, because the process has been severe and sudden, and has brought forth more of the acute inflammatory products, and because the defensive tissue-cells have failed to arrange themselves in the usual order ob-



Fig. 1

Fig. 7

Fig. 8

Fig. 9

Fig. 2

Fig. 5

Fig. 3, 4

Fig. 6



Gradual Metamorphosis of Parenchyma during Progressive Caseation  
showing Destruction of Vascular Supply. (Leveillé.)





served in the more chronic lesions. However, in following these cases of galloping consumption it is not uncommon to see the process limited, the picture assuming that of chronic ulcerative phthisis; which means that the tissues have reacted, and the invading broncho-pneumonic area has had thrown around it a protective layer or epithelioid cells, and a similar layer of leucocytes. In other words, a tubercle has been formed, which is Nature's effort at limitation, and her first step toward making of it a foreign body, her only method of cure, which in turn is accomplished by the fibrous capsule thrown out around it. In chronic ulcerative phthisis there may be seen at the same time all kinds of lesions; miliary tubercles; areas of broncho-pneumonia; caverns of various sizes and shapes, sometimes communicating with one another, undermining the greater part of a lobe or lung. Traversing the walls of these cavities are frequently seen arteries which, owing to lack of support, have developed upon them aneurismal dilations, which subsequently rupture and give rise to hæmorrhage. These cavities may be either dry, representing a healed process, or they may contain muco-pus or pus, and have lining them a pyogenic membrane. The bronchial glands in pulmonary tuberculosis are frequently invaded; they may show infiltration, areas of caseation, or may become impregnated with lime-salts. The pleura is usually involved, and the entire sac may be obliterated; a caseating mass may rupture into the cavity instead of a bronchus, and give rise to an empyema or pyopneumothorax.

**Symptoms.**—**FIBROID PHTHISIS.**—Fibroid phthisis, as its name implies, is a condition in which there is a preponderance of the fibrous element; it frequently commences as a pulmonary cir-

rhosis upon which later the tubercular process is superimposed; in many instances it is tubercular from the beginning. Owing to fibrous contraction, there is marked diminution in the size of the affected lung; the thorax caves in to fill the space caused by shrinkage of the organ, which leaves a larger area of chest-wall exposed to the apex-beat—when the change affects the left lung. The disease may last for years and the patient enjoy, during that time, fairly good health; there is usually dyspnœa on exertion. With the formation of cavities the usual physical signs appear, and more or less profuse expectoration occurs, which may, owing to its retention, become foul and undergo putrefactive changes—causing a horribly-offensive odor. Erosion of blood-vessels gives rise to frequent hæmorrhages, which may finally prove fatal. There is little absorption, owing to the effectiveness with which the process is shut off from the general system, and, consequently, no fever. Amyloid changes are common.

**PHTHISIS FLORIDA, OR GALLOPING CONSUMPTION.**—In acute, or galloping, consumption there is usually the clinical picture of an ordinary lobar pneumonia—with suddenness of onset and chill rapidly followed by fever, pain in the side, and cough with rusty sputum. There are the ordinary physical signs of increased tissue-density. The crisis fails to appear at the expected time, and with the breaking down of the broncho-pneumonic area, which occurs in the latter half of the second week, there is a profuse muco-purulent expectoration, which may excite suspicion of the real nature of the trouble. An examination of the sputum shows numerous bacilli, and the clinical picture now becomes one characteristic of pus-absorption. There are chills, fever, and drenching

sweats; the temperature becomes irregular and shows the usual evening rise; the pulse is weak and frequent, the respirations rapid, and there may be marked dyspnœa. The hectic state soon supervenes, and the patient dies from gradual exhaustion.

Upon opening tubercular abscesses many years ago, before antiseptic precautions were observed, infection by pus-cocci took place, a mixed infection resulted, and the clinical picture dominating the case, that which gave it its similarity to consumption, came on only after communication with the air had been established, or, in other words, after secondary infection had occurred. It is the pus-coccus which is largely responsible for the picture long recognized as consumption, and not the bacillus of tuberculosis. Eliminate the result produced by its action in chronic ulcerative phthisis, and that disease would never have been known by the familiar name which it now bears. Pulmonary tuberculosis of the chronic ulcerative type should be looked upon in almost every instance as a dual disease, one in which several factors, chiefly two, are simultaneously at work, and in which the bacillus of tuberculosis and the pus-coccus play the relative parts; the one, the bacillus, through its coagulation-necrosis acting as the gate-opener to the other, the pus-coccus, the peptonizing invader which liquefies the tissues and produces that poison which, when absorbed, gives rise to chills, fever, sweats, emaciation, and the consumptive appearance.

**CHRONIC ULCERATIVE PHTHISIS.**—The onset of this disease is varied; it may have commenced in an acute tuberculosis of the lungs which has merged into the chronic type. It is not uncommon to see a galloping consumption di-

agnosed as pneumonia or typhoid fever, and after several weeks the case pass on to one of chronic phthisis.

By far the commonest mode of onset is with a bronchitis; the patient may have been severely exposed, and speaks of having contracted a cold which finally settled on the chest and which he cannot get rid of; there is more or less cough, dry at first; but finally profuse expectoration occurs, with fever and emaciation.

The disease may first manifest itself by gradual loss of strength and appetite; vomiting may occur, and there may be marked anæmia. Frequently it is ushered in by hæmorrhage, which may be either profuse or slight; usually the amount of blood lost is slight. The patient may experience a sensation of tickling over a given lung-area, but is seldom able to tell from which lung the hæmorrhage takes place. These hæmorrhages may occur at varying intervals of years, with little or no progress of the disease, or, as occasionally happens, the other symptoms rapidly appear and the patient succumbs to the disease in a short time.

The rupture of some ramification of a pulmonary artery passing through a cavity is usually the cause of the blood-spitting. In 879 cases observed blood was expectorated in 30 per cent., and over half a litre in 15 per cent. This is a most unfavorable symptom if the temperature afterward rises, but in the early stages blood-spitting is usually a very favorable alarm-signal. Gerhard (Berl. klin. Woch., No. 21, '99).

It is quite common to see well-advanced laryngeal tuberculosis with only slight pulmonary involvement, but involvement to a greater or lesser extent almost always exists. The majority of cases of pleurisy with effusion coming on insidiously are of tubercular origin, and the suspicion is not to be abandoned



if the microscopical examination of that effusion prove negative. Localized areas of dry pleurisy are frequently the first indication of a tubercular process. In the beginning the disease often simulates intermittent malaria, with chill, fever, and sweat; but its resistance to quinine should excite suspicion, particularly if there are other factors in the case, such as cough or gradual loss of weight. In children tuberculosis of the lungs not uncommonly results from the downward extension through the lymph-channels communicating with diseased cervical glands.

Pulmonary tuberculosis in children frequently manifests itself without a cough. There may be moist râles at times, a little harsh breathing, and slight elevation of the temperature. Frequently there are small areas of dullness in the lung, caused by either consolidation or from enlarged and swollen bronchial glands. Then, again, there are cases of tuberculosis in which there may be no pulmonary symptoms or either percussion or auscultation, and where the clinical history is absolutely negative.

The symptoms to be relied upon chiefly in making a diagnosis are loss of weight, disturbances of digestion, a slight attack of febrile malaria, besides constant irritability. Such children will frequently show very slight, if any, pulmonary symptoms, so that the diagnosis must be made by a process of exclusion. Such distinct diagnostic features as the presence of cough, expectoration and tubercle bacilli, dullness on percussion, with moist râles and night-sweats, as found in the adult, are out of the question. It is not an easy matter to diagnose a case of tuberculosis, and it is a safe advice to follow, "to observe a suspected case of tuberculosis for several weeks, and sometimes months before giving a positive opinion relative to either the diagnosis or more particularly to the prognosis in a given case." Louis Fischer (*Jour. of Amer. Med. Assoc.*, Oct. 29, '98).

With the appearance of the onset, after a greater or lesser period of time, the other symptoms of the disease usually manifest themselves. The slight, dry, hacking cough becomes more pronounced and productive of a thick, muco-purulent expectoration; it may either be increased or decreased by lying down or upon assuming certain positions, and in many instances causes great pain, particularly aggravating that of the usual then existing pleurisy. The sudden, convulsive movements to which the thoracic contents are subjected result in more or less trauma. As softening and breaking down take place, the expectoration becomes more profuse. Cough is Nature's effort at drainage; it is her attempt to rid the organism of an offending substance, no matter whether that be an irritating area of pleuritic inflammation in the first stage of the disease or broken down and softened lung-tissue—in other words, sputum—in the later stage. It is an accompanying provision for this breaking-down process and for the emptying of night accumulations occurring in cavities. Many patients after this morning cough, which rids them of the excess of sputum accumulated during the sleeping hours, this resulting from decreased reflexes, pass the remainder of the day in comparative comfort. The cough may be of such severity as to produce vomiting, and is apt to become worse at night after the patient has gone to bed; he may have several attacks before morning. These occur with some degree of regularity and produce loss of sleep, while sweating follows the violent exertion.

Pain in the chest, usually localized and corresponding to an area of pleurisy; sharp, knife-like, and sudden; increased upon exertion, cough, or breathing, may

persist for days or weeks or it may be transient.

Rapid emaciation and loss of weight is found in nearly every instance at some stage of the disease; it is frequently the first thing to attract the patient's attention to himself, and, taken alone, is one of the surest guides of the progress of a case.

*Sputum.*—The sputum varies greatly in quality and quantity, and depends somewhat upon the rapidity with which destruction is going on, and whether or not there be a mixed infection. It may be mucoid, muco-purulent, or purulent, then watery; or may contain the thick, yellowish, lump-like masses which sink and which may have created suspicion of the real nature of the trouble. Bacilli are found in varying numbers and are particularly numerous in the cheesy particles which show up plainly when a layer of sputum is spread upon a smoked glass. There may be calcareous masses or chalk deposits in which bacilli exist in great numbers—those representing cast-off foci. Elastic tissue is evidence of destruction; it may be seen with the naked eye, and under the microscope it is often possible to determine its source, whether from blood-vessel, bronchus, or alveolus. In cases showing mixed infection there may be seen the various forms of pus-organisms. Red blood-cells are not uncommonly found, particularly after blood-spitting, and the migrating white cell is rarely absent.

Stress is laid on the importance of an early diagnosis, on examination of the sputum and the respiration; other physical signs not recognized. The examination must be made daily, and sometimes it will be only after the twenty-fifth or thirtieth time that the exact seat of the complaint can be located. Osler (*Med. Rec.*, Sept. 9, '99).

The fever of tuberculosis varies with the stage of the disease and the rapidity

of the process. In incipient cases the thermometer may register normal for the greater part of the day, and show only a slight rise toward evening. A constant evening rise of temperature of from one-half to one degree, particularly if the patient is debilitated or shows signs of dyspepsia, should excite suspicion. The maximum temperature occurs about four o'clock in the afternoon, the minimum about four o'clock in the morning; but there are many irregularities, and the temperature-curve, as well as the disease, is erratic. Not uncommonly, in the advanced stage when marked asthenia exists, the thermometer fails to register by mouth, while, at the same time, the rectal temperature will be above normal; this is more likely to occur in the morning. The temperature-curve may simulate that of malaria; but, with the beginning of the breaking-down and softening process and with the absorption of fever-producing products, it becomes continuous, showing marked irregularity and the tendency to evening exacerbations. When mixed infection with the pus-cocci is present, there is the characteristic temperature of pus-absorption. In far-advanced phthisical patients, rest in bed, in many instances, converts a remittent temperature-curve into one that is intermittent; and, *vice versa*, following exercise, an intermittent curve may become continuous and assume the remittent type. The pulse, as the fever, varies with the degree and rapidity of the process; it is usually rapid and soft, and such a pulse may have been the first thing to cause suspicion of the disease. The veins become more prominent, owing to the wasting of their tissue-beds and the pale, anæmic background upon which they are seen.

Active exercise, meaning by this a fairly rapid walk of from two to four miles upon a level road, increases the



bodily temperature to some extent, even in health. In convalescence, anæmia, chlorosis, and other constitutional states, temperature may reach as high as 100.5° F. A temperature above this is almost always indicative of tuberculosis. All suspected cases in which active exercise was followed by a temperature above this, were invariably found to be tubercular. Penzoldt (*Med. Rev.; Amer. Med. Comp.*, July, '99).

Night-sweats are common, and are one of the features of the disease; they may follow violent coughing-spells or the subsidence of the fever. In the early hours of the morning the patient awakes to find himself covered with moisture; his night-garment may be saturated and the bedclothing moist. These sweats are chiefly the sweats of exhaustion.

After the initial hæmorrhage, in the beginning of the disease, there may be an absence of symptoms for months or years, or recurrent hæmorrhages, which are usually slight, may occur and may be a special feature in the case; a blood-tinged expectoration which lasts for weeks, producing more or less anæmia and gradual exhaustion, is quite common. Oftentimes hæmorrhage comes on independent of exertion, while the patient is in bed or is quiet, and in many instances there is subsequently a marked general improvement, while in others the disease may rapidly progress and the patient pass on to an advanced stage. The bleeding which occurs early in phthisis is usually slight, and death from hæmorrhage is rare; later, after ulceration and cavity-formation have taken place, erosion of a large vessel not uncommonly occurs, and the respiratory tract may be inundated and the patient die of asphyxia. A cavity may fill with blood, and the weak condition of the patient prevents him from raising it, under which circumstances it remains concealed. The disease may terminate

by syncope, coma, or asphyxia, but the latter is a rare condition, and death most often occurs from exhaustion.

Toxin absorption in the tuberculous area causes reduced assimilation and fever. Loss of weight is in all probability due to this. It is not the amount eaten, but the amount assimilated that is of value to the consumptive. Carefully regulated rest and exercise are of most importance as regards the bodily weight in pulmonary tuberculosis. Forced muscular activity is always injurious. Assimilation is often markedly increased by change of residence or of climate. Excessive gain in weight may be injurious. The gain in weight is usually first evident on the chest, next upon the abdomen in men and on the hips in women. A quick, constant and continuous loss of weight indicates as surely as any other phenomenon that a patient is rapidly losing ground. A gain of a few pounds is of little value in prognosis, but if the gain is constant and continuous over a period of two months, the patient is probably improving. The weight gained affords no sure data for prognosis, but on the whole patients who gain over 20 pounds do better than those who gain less. Sunshine and dryness are not necessary factors of gain in weight. Cold weather stimulates assimilation and gain in weight more than warm. Lawrason Brown (*American Medicine*, April 25, 1903).

**Physical Diagnosis.**—In any well-advanced case of ulcerative phthisis pathologically there may be seen at the same time all stages of the disease which, for convenience of clinical study, will be arranged in the following order:—

The first, or incipient, stage, or that of infiltration and beginning of consolidation. The second, or moderately-advanced stage, or that of advancing consolidation and the beginning of softening. The third, or far-advanced, stage, or that of softening, break-down, and cavity-formation.

**INFILTRATION.**—There is slight defective percussion resonance over the affected area, and, on palpation when standing behind the patient and placing the hands in the supraclavicular spaces, a slight increased vocal fremitus over the diseased apex is revealed. This increased fremitus is usually first appreciated over the apex posteriorly. On auscultation there is a slight increase of vocal resonance.

Inspiration loses its breezy character and is partially suppressed, generally becoming broncho-vesicular in character, its duration shortened, and there is a slight interval between its termination and the beginning of expiration. The latter is *high in pitch* and is prolonged; jerky, cog-wheel, or wavy respiration is often heard.

The following method of examining the lung will reveal a very small lesion. The patient's hand is placed on the opposite shoulder, the ear is placed over that portion of the lung uncovered by the scapula, viz.: just above and external to where the bronchial tubes are given off; there will be heard prolonged tubular breathing and fine râles on coughing. This is the very first physical sign of tuberculosis—an evidence which will make a diagnosis possible weeks before the signs are evident in front and beneath the clavicle. The tuberculin test is useful both in making the diagnosis of a beginning case and in deciding if a case is cured. It is to be applied in the following manner: The patient's temperature is to be taken every six hours for a few days to see he has no diurnal temperature above normal; then  $\frac{1}{2}$  milligramme of tuberculin is injected and his temperature is taken every four hours during the next twenty-four hours. At the end of two days, if there has been no temperature above one degree, a second injection of 2 milligrammes should follow; if there is still no reaction after two days more, a third and final injection of 5 milligrammes is given. If there is still no reaction, the patient is free

from tuberculosis. H. P. Loomis (Med. Rec., vol. liii, No. 21, '98).

The following are criteria for the early diagnosis of tuberculosis:—

Intermittent pretuberculous albuminuria, often alternating with phosphaturia.

Tuberculous pseudochlorosis, distinguished from the true by the fact that there is less lowering of the hæmoglobin standard, slighter accentuation of the cardiovascular phenomena, and by the presence of leucocytosis.

Disturbances of the digestive apparatus: anorexia alternating with voracious appetite; gastralgia.

Afebrile tachycardia, characterized by the greatest instability.

Lowering of the blood-pressure.

Marked and permanent rises of temperature following active movement, and in women elevations of three- to four-tenths each day before the oncoming of menstruation.

Tendency to sweats, not only nocturnal, but also following the slightest fatigue and emotion.

A sense of pain in the nuchal and supra-orbital region, the upper part of the trunk, etc.

Inequality of the pupils, and, according to some, dilatation of both; this is rare.

Appearance of herpes zoster in the area of the distribution of the fifth pair in meningeal, and on the thorax in pulmonary, tuberculosis.

The color of the gums: red in those suffering from acute forms, bluish in chronic cases, and white in scrofulous individuals.

Pretuberculous enlargement of the spleen.

Amyotrophy of the thorax.

Dyspnœa, cough, etc.

Hæmoptysis, when there is no other cause for it, but hysterical suggestion must be guarded against.

A sensation of resonance felt by the individual in talking.

Percussion; this is of little importance, owing to the possibility of asymmetry, or insufficiency of air owing to marked atrophy.

Auscultation: the bases also must be



auscultated; harsh breathing at one apex should not always be taken as an indication of tuberculosis.

Injections in guinea-pigs.

Serum diagnosis after the Arloing-Courmont method.

Fluoroscopy and radiography, but discount should be allowed for exaggeration.

Injection of small quantities of physiological serum; this gives a febrile reaction in all grave anæmias, even non-tuberculous.

Injection of tuberculin; this is the best criterion of all, but, as it may make a chronic process acute, it should be used only when it is absolutely necessary. Bozzolo (Tuberculosis Congress; Brit. Med. Jour., May 19, 1900).

Arloing and Courmont say that by the employment of homogeneous glycerin-bouillon cultures of the tubercle bacillus an agglutinating action of the serum of tuberculous subjects can be obtained. The difficulty lies in preparing a suitable culture. The test requires a rich culture eight to twelve days old. In a recent paper (*La Presse Médicale*, Sept. 1, 1900) they reach the conclusion that an agglutination of the tubercle bacillus by the serum of tuberculous patients is usually found very early in the course of the disease. It is commonly obtained in a dilution of from one to twenty to one to five. The maximum of intensity is found in those patients having discrete lesions, those suffering from generalized tuberculosis not presenting the reaction in the same degree. This diagnostic method is devoid of any possible danger to the patient.

The serum-reaction for tuberculosis tried in 40 cases. Three absolutely healthy persons gave no agglutination in a dilution of 1 to 3 or 1 to 5. Thirty-eight cases of tuberculosis were tested, and in only 2 cases was the reaction negative; and both of these were cases of advanced phthisis. The milder cases of phthisis gave the most pronounced

reactions and reacted in the greatest dilutions, while severe cases gave the reaction only in smaller dilutions. The serum-reaction is of great importance in the early diagnosis. Bendix (*Deutsche med. Woch.*, Apr. 5, 1900).

In making use of the tuberculin test it should be remembered that: 1. The dose of tuberculin which does not produce a reaction temporarily increases the tolerance of the patient to subsequent doses; therefore, the smaller the increase in dose, the greater must be the interval between doses. 2. The smaller the dose required to produce a reaction, the more reliable the diagnosis; therefore, the importance of searching for the local manifestations after all doses over 5 mg. 3. The salicylates, probably all the chemical antipyretics, and some other drugs interfere with the test; therefore, all drugging must be omitted during the test.

Again: 1. The full appreciation of the value of percussion and auscultation findings and of symptoms is dependent upon the recognition of the limitations of the significance of their presence or absence. 2. Deductions from temperature may be made from only frequent, regular observations. 3. An auscultation chart made while listening to the sounds is an essential aid to accuracy of both observation and record. 4. Negative sputum findings are never sufficient ground for negative diagnosis. 5. Blood examinations throw no light upon diagnosis of tuberculosis in its incipency, except in excluding those conditions in which the blood findings are characteristic. 6. Significance and reliability of agglutination are not yet fully established. 7. The tuberculin test is a safe, reliable, practical, and justifiable diagnostic resource in those cases in which its use is indicated; that is, in those cases of suspected early tuberculosis in which all other means have failed to clear up the diagnosis. When a positive diagnosis can be made without the tuberculin test, its use is to be condemned as a meddlesome procedure. W. L. Dunn (*American Medicine*, Oct. 17, 1903).

**SECOND STAGE, OR CONSOLIDATION.**—As the process advances from infiltration to consolidation the physical sounds become more pronounced, fremitus and vocal resonance are much increased, and on inspection there is seen a failure of expansion over the affected area, with slight sinking in of chest-wall. The percussion-note is dull, higher in pitch, shorter in duration, wooden in character, and the percussion resistance is much increased; deceptive cracked-pot resonance may be obtained over the main bronchi, and on auscultation, as the vesicular element becomes eliminated, the broncho-vesicular passes into bronchial breathing and bronchophony results.

The expiratory note is now very markedly prolonged and blowing or tubular in character. Not infrequently the heart-sounds are heard over these consolidated areas with as great or greater intensity as at the normal site of the apex-beat.

At the point where the process is most advanced scattered or isolated crepitant râles are now heard at the end of inspiration, and gradually become more closely massed and progressively pass into subcrepitant and mucous râles, which indicate the beginning of softening, followed by breaking down of the tissue as the disease passes into the third stage.

**THIRD STAGE, OR THAT OF CAVITY-FORMATION.**—On inspection there is now seen superficial and rapid breathing and uneven expansion of the two sides of the chest; sinking in of the supraclavicular and infraclavicular spaces causes undue prominence of the corresponding clavicle. The auxiliary respiratory muscles of the neck stand out prominently, owing to the general emaciation and to the increased work thrown upon them. The angle of the scapula of the affected side, upon deep inspiration,

lags behind its fellow, and fails to make the normal excursion. The intercostal spaces are wider than usual, and the chest is frequently long and thin and the scapula winged.

Increased vocal fremitus is found over consolidated areas and over cavities, is much intensified, and is of considerable diagnostic value.

Often the heart's impulse is distinctly visible at some distance from the patient; the more the lung is contracted, the wider the area over which this impulse can be seen.

It is not infrequent to hear, in patients having cavities, when they are asked to open the mouth and to breathe as gently as possible, a short puffing sound similar to that produced by blowing over the open mouth of a small bottle; it occurs with each heart-beat and is evidently produced by that organ acting as a plexor and the intervening tissue between it and the cavity-wall as the pleximeter. It might naturally be supposed that the nearer the heart to the cavity, the greater distinctness with which the sound would be heard; but in cavities at either apex the sound is heard with peculiar loudness.

The dullness found on percussion in the second stage continues throughout the later stage of the disease and over cavities with their walls in open communication with a bronchus; cracked-pot resonance is obtained when the patient is directed to open the mouth and a quick sharp percussion-stroke is made.

On auscultation sharply-defined subcrepitant râles give way to moist, bubbling râles of all sizes, and when cavitation has occurred there will often be heard the metallic tinkle or mucous click.

Over the site of the cavity will be heard a blowing, cavernous, or amphoric



breathing, while around about it will be heard tubular and bronchial breathing varying in intensity according to the density of the consolidation, and in some instances the bronchial breathing will vary in degree in different areas near or remote from the cavity.

Whisper-resonance is generally present and is marked in character.

**THE ROENTGEN RAYS AS A DIAGNOSTIC AGENT.**—The Roentgen rays have become, during the past few years, an accepted diagnostic agent in pulmonary diseases. During 1896 and 1897, Bouchard, of Paris; Stubbart, of Liberty; and Williams, of Boston, published, in the order named, papers showing positively that, by means of shadows and lights thrown on the fluoroscopic screen, many diseased conditions could be accurately diagnosed.

Generally speaking, the Roentgen rays are valuable in corroborating signs discovered by auscultation and percussion, but, at times, by their aid, we can discover incipient lesions or small isolated foci of infection not recognizable by ordinary methods of examination.

Tuberculin as a diagnostic test has proved disappointing and it has been abandoned at the Nikolas Hospital on account of the dangers connected with its use. Measurement of the respiratory capacity of the lungs by means of the spirometer, which has been recommended as a method of diagnosis in tuberculosis, has not given satisfactory results, the figures obtained being uncertain and variable. The use of the Potain sphygmomanometer to determine the blood-pressure of tuberculous patients did not give definite information, as blood-pressure varies within wide limits in early stages of the disease. The Ehrlich diazo-reaction was obtained in some cases, but was not present constantly, and could not be used as a diagnostic aid. Roentgen rays very frequently offer a means of controlling

and confirming the data of physical examination. As such, it is of great value in the early diagnosis of tuberculous lesions. The presence of consolidation at the apices of the lungs, as elsewhere was evident on x-ray examination, and the presence of fluid in the pleura could always be made out. D. I. Vieruzhsky (Roussky Vrach, Apr. 26, 1903).

In addition, the fluoroscope enables us to recognize more fully and accurately the degree, position, and relation of areas of infiltration and consolidation, and also delineates plainly the limits of these areas.

*Method of Examination.*—Two things are requisite for the successful use of the fluoroscope: a certain amount of practice and a primary knowledge of the fluoroscopic picture of a normal thorax. The thinner the subject, the more immediate and easy the diagnosis. In all subjects one has, as does the tyro with the ophthalmoscope, to look for nothing until he can see something. The patient is placed standing before or lying above the Crookes tube for examination by the fluoroscope. A better method, however, is to seat the patient on a chair without a back, with the Crookes tube held between the scapulæ and the fluoroscopic screen in front of the chest. A dark cloth now being placed over the tube and the patient's shoulders, concentrates all the light upon his chest, and the whole outline of the thorax appears as a picture upon the screen in front of the patient.

The advantage of this method is that both sides of the chest are exposed simultaneously; the comparisons are, therefore, more accurate.

When the fluoroscope is used it should be applied firmly and evenly to the bared chest, and, the two clavicles having been located, their relative distinctness of outline will generally indicate the side which is involved.

Having examined the apices, the fluoroscope is passed up and down the whole thoracic region in search of other foci of infection.

*Normal Chest.*—In about 50 per cent. of normal chests the right apex is not quite as clear as that on the left side. The normal lung is more transparent, and the reflex brighter at the end of inspiration. The ribs are more clearly defined during inspiration, and in a healthy chest an evenly clear transmission of light is visible between them.

*Infiltration.*—In cases of slight infiltration there is a haziness or fog between the light and the observer. The clavicle may, in other instances, appear to have a gauzy veil thrown over it. This haziness, as the infiltration advances, becomes a light shadow, the ribs becoming more indistinct, and the borders of the haze or shadow fade away gradually to a normal reflex. On deep inspiration this light shadow becomes slightly more gray in color.

Occasionally a slightly-thickened pleura at the apex may lead one to diagnose infiltration, or, rather, the beginning of consolidation, as the pleural shadow is darker than a haze. When, however, we remember that a sharply defined pleurisy at the apex generally signifies underlying tubercular infiltration, there is but a slight chance of error in diagnosis.

*Consolidation.*—When there is marked consolidation, the transmitted light is relatively less, the edges of the clavicle are indistinct, or the bone may be invisible. The limits of the consolidated area are sharply defined, and ordinarily are bordered by an area of haziness. When pathological changes are present at both apices it is an easy matter, by comparing the two sides, to decide upon which the disease has made more prog-

ress. Comparative shadows at the apices are generally more clearly defined from behind than in front.

By use of the fluoroscope a practiced eye can clearly distinguish areas of the most incipient infiltration, sometimes before appreciable by auscultation or percussion and very often before their presence has been suspected. Williams, of Boston, says that, when examining a lung known to be diseased, he has found an unsuspected focus of infection at the opposite apex. The writer has found foci of disease in the lower portion of the lungs in a number of cases under treatment for apical disease. In some instances these spots cleared up; in others auscultatory signs subsequently developed.

In cases of complete dullness, say to the second interspace, with relatively less dullness for one or two interspaces below, a dark shadow will be seen over the first-named region, that of consolidation, which will gradually shade off consecutively into haziness and normal reflex of light below, the area of haziness corresponding to the limits of relative dullness or infiltration.

*Softening or Excavation.*—As consolidation gives way to softening, flashes or spots of light come through the darkness; then we note a fairly well defined area of light with dark spots scattered through or dark lines or reticulæ across its face; this represents disintegrating tissue. And finally the dark spots or lines of *débris* disappear, and then appears the bright reflex of a formed cavity. Cavities appear as more or less well defined areas of brightness amid shadowy tissues. When perfectly round they appear like a full moon behind a cloud. Such small regular-shaped cavities may be situated in a large area of dense shadow or merely surrounded by



a ring of darkness, the limits of these shadows corresponding to the area of percussion-dullness. It is more difficult to map out or even diagnose positively, large, irregularly-shaped cavities, and very often one must have recourse to the steel rod as an aid, the shading off being too uncertain for the eye alone to determine the limits of the excavation. In cases of multiple cavities the dense intervening fibroid tissue will be shown in the form of dark streaks winding between the spots of bright reflex. These streaks, or bands, differ in appearance from those seen in areas of softening, in that they throw a darker shadow, and the light does not penetrate them in spots as it does the tissue undergoing disintegration.

*Miliary Tuberculosis.*—This form of phthisis shows itself in scattered dark spots, giving the lung a mottled appearance; there is nothing regular about the arrangement or size of the spots; when cavitation has occurred it is, as a rule, relatively difficult to define the outlines of the cavities.

**Prognosis.**—It is important to be able to give a fairly-accurate prognosis both as to the ultimate result of disease in a given area, as well as the length of time that will be required for its termination either favorably or unfavorably. Uncertainty of prognosis entails positive suffering upon patients and their families. Pulmonary tuberculosis in the majority of instances is not necessarily a fatal disease, and the percentage of cures is increasing ever year. The number of cures at the Loomis Sanitarium at Liberty, N. Y., during 1899, is a fair illustration of the fact that a large majority of cases in the first and second stages can either fully recover or sufficiently arrest the disease, or improve their condition so as to resume their

usual family and business responsibilities.

#### CONDITION OF PATIENTS WHEN ADMITTED.

Incipient stage without bacilli.....	12
Incipient stage with bacilli.....	23
Moderately advanced .....	50
Far advanced .....	14
	<hr/> 99

#### CONDITION OF PATIENTS WHEN DISCHARGED.

Incipient stage without bacilli.....	25
Incipient stage with bacilli.....	10
Moderately advanced without bacilli.	5
Moderately advanced with bacilli...	45
Far advanced .....	14
	<hr/> 99

The disease is more often contracted by females than males, but the prognosis is more favorable among the former, there being a difference in the percentage of cures of about 60 per cent. females to 40 per cent. males. This is due probably to the fact that her social condition allows her to place herself more promptly within proper environment for recovery of health.

The prognosis is most favorable between the ages of eighteen and thirty.

Environment has a decided controlling influence over the results of treatment. Proper climate, hygiene, and social diversions, as well as mental quietude, all tend toward a favorable result. Probably one explanation of the unfavorable results following various methods of treatment in homes and hospitals in cities is the lack of proper environment.

Heredity influences prognosis unfavorably if it has given to the patient a lack of vital capacity or corpulence, a malformed chest, or numerous foci of tuberculosis manifested during childhood.

The character and location of the pathological process has a strong bear-

ing upon the results of treatment. The more tendency there is toward fibrosis and limitation of the disease to a given area, the more favorable the prognosis. Lesions of all characters at the apex heal more rapidly than those located at the base or middle portion of the lung. For instance, even a cavity at one apex will heal more certainly than a consolidation at the base. Small foci scattered through one or both lungs, accompanied, as they generally are, by systemic disturbances out of proportion to the physical signs, render the prognosis generally fatal.

Allowing for the possibility of over-exertion, excitability under examination, and the presence of mitral stenosis, all of which accelerate the pulse-rate, the frequency of the pulse is a useful aid in the prognosis of pulmonary tuberculosis. A patient with a pulse-rate of over 100 is not likely to make any approach to recovery from pulmonary tuberculosis during six months. Cases in which a tuberculous area in the lung has been cleared out by excavation, followed by a period of quiescence, during which the cardiac pulsations may not exceed 84 per minute, are suitable for treatment, as there is likelihood that life will be prolonged considerably by six months' residence in a sanatorium. A pulse of 100 or more will usually be found to accompany an evening temperature reaching or exceeding 101° F., and these two signs, of grave import, being persistently present in a case in which absolute rest has been enforced for some time, give little hope of treatment proving of any avail. Thompson Campbell (Brit. Med. Jour., June 1, 1901).

The earlier the disease is discovered and the patient placed under treatment, the more favorable the prognosis. Thus, in the pretubercular and the beginning of the incipient stage nearly every case should be cured unless there be some underlying hereditary influences which render almost *nil* the power of recuper-

ation or resistance. The following results at the Loomis Sanitarium substantiate this statement.

There have been 456 cases admitted to the sanitarium since it was opened; of these there were:—

Incipient cases .....	163
Moderately advanced .....	216
Far advanced .....	77
	<hr/> 456

Of these, 407 were discharged and 49 are still in the sanitarium. Those discharged were in the following condition:—

INCIPIENT CASES.

Cured .....	61
Disease arrested .....	25
Improved .....	59
Unimproved .....	1
Died .....	1
	<hr/> 147

MODERATELY ADVANCED CASES.

Cured .....	7
Disease arrested .....	10
Improved .....	121
Stationary .....	11
Unimproved .....	33
Died .....	3
	<hr/> 185

FAR-ADVANCED CASES.

Improved .....	3
Stationary .....	3
Unimproved .....	60
Died .....	9
	<hr/> 75

Therefore it is seen that of the incipient cases 58 per cent. were cured or the disease arrested, of the moderately-advanced cases 9 per cent. were cured or the disease arrested, while in the far-advanced stage only 4 per cent. were at all benefited.



Bacteriological examinations throw some light upon prognosis, and promise to become more valuable in the future. Much can be learned from the size, shape, number, and arrangement of the tubercle bacilli; the presence or absence and the relative number of the various cocci and leucocytes, and the presence of blood or elastic tissue.

When there is a gradual diminution in number of bacilli extending over long periods of time, passing from numerous to moderate, to few and finally to none, improvement may be inferred. But to base an opinion upon one microscopical examination of sputum, either for prognostic or diagnostic purposes, is not uncommonly homicidal to the patient. How often do we meet with instances in which a final and an erroneous verdict has been rendered after only one examination of sputum, which specimen happened to be negative, and the patient, in ignorance, has continued his pursuits and method of living, which may have been the deciding factors in his case!

As for the arrangement of the bacilli, there appears to be some reason for associating a sputum in which the bacilli are congregated into clumps, with few scattered throughout the field elsewhere, with an effort on the part of Nature and her ability to cast off individual foci; and it seems as if the protecting cells were able to prevent a general inroad upon the tissues, and had confined the invaders to individual bands and to local points of attack. This appearance is certainly common in incipient cases which are becoming rapidly improved.

The specimen of sputum which is thin, with numerous bacilli evenly distributed throughout the field, with a noticeable reduction of the corpuscular elements, the few that remain granular failing to take well the stain, is a vicious sputum,

and the thinness of it and the absence of the cells probably mean that the protecting phagocytes show such little resistance that the vast majority are broken up in the struggle, and the few remaining show a tendency to become disintegrated, thus demonstrating the poor resistance of the invaded tissue. Such a sputum is indicative of a low tissue-vitality, and it is the general character of this sputum upon which most reliance is placed.

When studied in sputum, tubercle bacilli present the following well-marked varieties of form, with more or less complete gradations between: 1. A very short, relatively-broad, rod. 2. A long form represented by a chain of rods. 3. A long form homogeneous in structure. 4. A long form of a beaded appearance, as if composed of a string of spores. The author believes that the form of tubercle bacillus, as it is demonstrated in the sputum, is an important indication of the virulence of the tuberculous process, and he considers it a useful guide to prognosis.

The short, deeply-staining rod or chain of rods of moderate length is the usual form in many active cases. The long rods, particularly if irregularly broken, betoken a milder process, and the chains of spore-like beads characterize the very chronic cases which make one wonder at their tenacious hold on life. If there be a good form of the tubercle bacillus it is a rather long, slender rod, ill staining or staining irregularly, as if the body of the microbe were irregularly corroded on the sides. It is found in cases apparently passing on to cure. Sputa of the same individuals, examined month after month, have seemed to vary in their bacillary characters with the state of the patient as regards the disease. Henry Sewell (*Med. News*, Mar. 16, 1901).

Complications affect the prognosis very appreciably. Diabetes, Bright's disease, or very decided functional disorders of the heart or an affection of the meninges, as well as destructive tubercular involve-

ment of the epiglottis or larynx, are among those that render the prognosis absolutely fatal. On the other hand, slight tubercular disease of the intestines, bladder, and kidneys is amenable to treatment. Tubercular involvement of the larynx, even if ulceration be present, if no extensive destruction of tissue has occurred, yield a fair percentage of cures.

Asthma seems to have a decided retarding effect upon the progress of pulmonary tuberculosis, delaying the fatal result sometimes for years. It also seems to prevent an absolute arrest or cure.

Thrombosis occurred 19 times in 1778 cases of pulmonary tuberculosis. Of these 6 patients were between 20 and 30, 7 between 31 and 40, 5 between 41 and 50, 1 was 60 years old. Of the patients 12 were women, 7 men. They were practically all advanced cases of phthisis in which death ensued within one or several months. The thrombosis affected a great variety of veins, most frequently those of the lower extremities. H. Ruhl and Hierokles (Berl. klin. Woch., Jan. 23, '99).

The prognosis in all stages of the disease is relative to the degree of carefulness exercised by the patient. Carelessness can render a case hopeless that possesses all the other factors that make up a good prognosis.

Ehrlich's diazo-reaction in tuberculosis. It is chiefly in pulmonary tuberculosis that the reaction is of high prognostic value. Cases which give absolute, undisguised, positive reactions to the diazo-test are considered fatal as to prognosis. Reagent used (the original one of Ehrlich) is as follows:—

#### REAGENT A.

Acid. sulphanilic, 2.5.

Acid. muriatici, 25 to 500.

#### REAGENT B.

Natrii nitrosi, 0.5 to 100.

Of Reagent A, 49 cubic centimetres are taken, together with 1 cubic centimetre of B, and well shaken. Then to about 10 cubic centimetres of urine is added a like quantity of the reagent, and again the mixture is well shaken. Finally, about one-eighth of the quantity of ammonia is added. Then, with positive results, a red coloration of the foam takes place. If the urine be allowed to stand for twenty-four hours a dark-green precipitate will form. It is to be noted that the ammonia is to be added, not by drops, but the requisite quantity at once. The previous ingestion of certain drugs such as naphthalin, chrysarobin, gallic acid, tannigen, and tannalbin seems to prevent the reaction from taking place. The presence of a positive reaction is independent of fever, of the number of tubercle bacilli, and of the quantity of the sputum. The diazo-test is rarely positive in mild cases of tuberculosis; and only when acute infections set in, which of themselves alone would give negative results, does it give a positive reaction. M. Michaelis (Berliner klin. Woch., Mar. 26, 1900).

#### Treatment.—SELECTION OF CASES.—

Individualization of patients is the keynote of successful treatment of tuberculosis; in nothing is this so manifest as in the selection of the climate or resort to which individuals should be sent.

Solly, for the sake of convenience, divides his cases into three forms: tuberculous, pneumonic, and catarrhal.

Purely tubercular cases, catarrhal cases, or those combining these two characteristics, do better in cold, dry climates, while for pneumonic cases a warm, dry climate is preferable. As the majority of cases met with present the dual character of tubercular and catarrhal, it may be stated that, in general, curable or arrestable cases do better in a cold, bracing climate at a moderate elevation of two to three thousand feet above sea-level. Again, we often meet patients in whom certain organic heart-lesions contra-indicate residence at a



high altitude or one whose disease is complicated by diabetes, indicating the necessity of moderately-high elevation.

The more incipient the tuberculosis, the more pure is its tubercular character, and such cases are better adapted to a high altitude.

In 169 cases with tubercle bacilli examined at the Adirondack Sanitarium, 42 per cent. had lost their bacilli on discharge; of the incipient cases 75 per cent. were apparently cured and of the advanced, only 19 per cent. This shows the better prognosis for the early cases. Other observations also prove that one specimen proves little or nothing in regard to prognosis. If the number of bacilli steadily decrease in a series of examinations at intervals sufficiently long, the patient may be improving, but the constitutional symptoms and local signs give much more accurate information. If on repeated examinations large quantities of tubercle bacilli are found, the disease had probably advanced to cavitation. Repeated observations seem to show that the morphology of the tubercle bacilli affords little or no ground for prognosis, but the short bacilli are suggestive of a more active process. Clumps are more apt to be found in the severe cases, but may occur in all. L. Brown (Jour. Amer. Med. Assoc., Feb. 21, 1903).

Change of environment is advantageous in itself, but of more importance is the selection of a resort at an altitude which seems to be indicated in individual cases. Very little can be said in favor of an altitude less than fifteen hundred feet; the experience of some seems to indicate that many patients do well at heights of five to ten thousand feet. The majority of the tuberculous, however, as they appear before the physician for advice, seem to do best at elevations of two to three thousand feet.

A few years ago the majority of patients sought warm climates in the winter and returned home during the

summer; the result in the majority of instances was eventually fatal. To-day it is a recognized fact, that if a given patient is possessed of ordinary resisting power, it is better for him to winter in a cold, dry climate rather than a mild one: for example, the Loomis Sanitarium at Liberty, New York, is situated on the top of a mountain-range exposed to rigorous, northwest winds at an elevation of twenty-three hundred feet above sea-level, and the winter temperature ranges between ten above and ten below zero, F., yet the percentages of good results attained are higher in the winter than in the summer months. It is undoubtedly a mistake to send to cold climates patients who have passed into the third, or far-advanced, stage of the disease,—in other words, hopeless cases,—first, because they do not possess sufficient vitality to be comfortable, and, secondly, because it is the inalienable right of a doomed man to spend his dying hours among his friends and kindred.

Having selected the locality in which it is hoped to effect a cure of the patient's disease, it is imperative to impress upon him the necessity of remaining *continuously* there until the desired end is accomplished. It is difficult for patients to realize the danger they incur by short visits to their homes or lower altitudes.

To obtain the full benefit of climatic influences, patients should remain out-of-doors from seven to ten hours a day during the entire year. It is astonishing how soon they become accustomed to such an out-door life; after having exercised sufficiently, they rest in chairs on verandas with the temperature ten below zero and the snow often blowing around them; such a length of time out-of-doors is not easily attainable among

private patients located in boarding-houses or hotels, their environment and associations tending more directly toward an in-door life, and it must be acknowledged that the percentages of good results are proportionately lower than among sanitarium patients.

Patients should pass their sleeping hours in a room with the windows widely open; it is of no moment if the cold air blows directly upon the bare head, providing the body and limbs are warmly covered.

At lower altitudes, those below fifteen hundred feet, the proper way to ventilate in damp weather is to have the windows open in the room adjoining that of the patient and have an open fireplace in the room the patient occupies; in clear weather, the room should be ventilated as described above.

There is among the tuberculous a fear of cold sponging; two or three hot baths should be taken each week and a tepid plunge-bath every morning, followed by a cold sponge and brisk rubbing.

The dirty and unsanitary spit-cloths so much in vogue and, unfortunately, advised by physicians, should never be employed; they are potent sources of contagion, soiling the clothing and hands; whenever it is possible, sanitary sputum boxes with close covers and combustible linings should be used and the linings burned daily. For use on the street and other public places nothing is better than the Dettweiler sputum-flask.

*Diet.*—Diet, in the treatment of tuberculosis, is a much abused and poorly understood term. It is a difficult thing to persuade many an incipient case that he must not, of necessity, stuff his stomach with concentrated nourishment from four to six times daily. In advanced cases at all times, and in a very few incipient cases when they first come under

observation, specially-arranged diets are necessary. In 90 per cent. of incipient cases nothing is better than three substantial meals a day.

The appetite of convalescing tubercular patients is something extraordinary. Climate, out-of-door life, and tonic treatment all tend to increase the powers of digestion; nevertheless, in most cases, periodically there will arise disorders from overfeeding, which will require treatment. Nothing is more simple to overcome than these so-called bilious attacks, and, after a rest of a few hours, the patient will recover his appetite and power of digestion.

However, we know that a large number of cases of tuberculosis is due, primarily, to lack of assimilation, and it is not strange that we find quite a percentage of patients with chronic gastritis and dilated stomachs. Most cases of this nature can be relieved by siphon irrigation of the stomach three times a week, and, if dilatation be present, Einhorn's electrode may be introduced and faradization practiced.

Milk or cream, meat, eggs, vegetables, and game are all staples that should be liberally provided. When patients first come under treatment, owing to a generally depreciated vitality, it may be advisable to allow a cup of broth or bouillon or a glass of milk between meals; but as early as possible this extra diet should be dispensed with. Occasionally, even in incipient cases, the digestive functions are so impaired as to make it imperative to select a special diet, until, by the use of electricity and lavage, they have been restored; the following is a good selection for most cases:—

7 A.M. Two soft-boiled eggs. Two slices of buttered toast. One cup of coffee with milk, cream, and sugar.



9.30 A.M. Koumiss (10 ounces) and two slices of bread and butter.

12.00 M. Lamb-chops, steak, or chicken. Mashed or baked potatoes. Boiled rice in milk. Toasted bread and butter. Weak tea with milk and sugar.

3.00 P.M. Same as 9.30 A.M.

5.30 P.M. Meat-soup with farina or the like in it. Squab or other meat. Spinach, asparagus, green peas, thickened rice, or some pudding (custard).

8.30 P.M. Koumiss, crackers and butter, or oysters, ale and crackers, or a sandwich and stout.

*Individual Medicinal Treatment.*—There is too great a tendency among the profession to depend mainly upon one line of treatment in this disease. Either the patient remains at home and becomes the recipient of medicinal treatment or is sent away with the instruction to depend upon climatic influences for the arrestment of his trouble. Clinicians of experience among the tuberculous in various health resorts all recognize that good results can generally be looked for *only* when climatic influences are supplemented by judicious symptomatic treatment.

Only a few years ago the recognized treatment of phthisis was to administer sedative cough-mixtures and deliver the hopeless patient over to the kind and cheerful ministrations of priest and neighbor. Then came the era of dosing, and codliver-oil and creasote followed. Now climate, hygiene, and dietetics very properly form the basis of all intelligent treatment of tuberculosis. The remarkably encouraging results attained at sanitariums in America and abroad have aroused the profession from a lethargy born of hopelessness.

The public is at last beginning to understand, not only that tuberculosis is infectious, but that it is, in a large

majority of cases, susceptible of cure. Recognizing this fact, the various health resorts of the country have been, for the past year, more than ever crowded with victims of this dread disease. Unfortunately, very many are imbued with the idea that climatic influence alone is all that is needed to restore them to health.

No general line of treatment can be laid down for even a small percentage of tuberculous patients. We must not expect to treat successfully pulmonary tuberculosis in the abstract, but every case must, in justice, be treated in accordance with its individual manifestations of disease, idiosyncrasies, and complications.

Probably it is this individualizing of patients that is largely responsible for the comparatively flattering results obtained among sanitarium patients over those attainable in private practice in the same climate.

In very incipient cases, in those of the pretubercular stage, climate and out-of-door life are generally all that is necessary to insure recovery, but, unfortunately, the percentage of such cases is small when the disease is recognized. The general run of so-called incipient cases all present complications of one sort or another demanding treatment in order to remove conditions which, if allowed to remain, will, to say the least, severely handicap the patient in his fight for life and restoration to health.

Symptomatic treatment and individualizing of patients are exceedingly important in all cases. Almost invariably anæmia is present and must be removed. This is most readily accomplished by administering iron and static electricity. Among various forms of iron the following are preferable: pep-to-mangan, tr. citro-ferri chloride, and Blaud's pills. Static electricity should

be given for one hour daily, the patient being charged through the negative pole except in decided neurotics, in whom the current should be reversed. Functional cardiac disorders should be controlled by strychnine, digitalis, strophanthus, or glonoin. Strychnine in mild cases should be given in doses of  $\frac{1}{100}$  grain three times a day; in more advanced cases larger doses should be used. Bitter tonics are indicated from time to time; a happy combination in the majority of cases may be:—

R Tr. nux vomica, gtt. v-x.  
Tr. gentian co., 1 drachm.  
Fl. ext. condurango, gtt. v-x.

M. Sig.: Three times a day.

Syrup of hydriodic acid combined with syrup of hypophosphites is also an excellent tonic.

*Coughing* is best controlled by codeine sulphate,  $\frac{1}{4}$  to  $\frac{1}{2}$  grain; or heroin,  $\frac{1}{12}$  to  $\frac{1}{6}$  grain, given according to circumstances every three or four hours or at bed-time. All forms of cough-mixtures and syrups are mischievous.

*Night-sweats* are controlled by atropine in most patients; hypodermic injections of nitrate of silver are reported to be of value in obstinate cases; camphor is at times advantageous.

In night-sweats camphoric acid acts more powerfully than either atropine or agaricin. The tendency to excessive sweating seems to disappear. Thirty grains should be given at night two or three hours before the sweating begins, or in two doses at short intervals, in powder, capsules, or cachets. Ralph Stockman (Edinburgh Med. Jour., Jan., '97).

The night-sweats of phthisis may be controlled by giving an hypodermic injection of  $\frac{1}{80}$  grain of atropine sulphate at bed-time. After three or four nights it may be suspended, and it may not be necessary to revert to it for a week or more. Picrotoxine, in doses of  $\frac{1}{60}$  grain

at bed-time, is also of value. William Murrell (Med. Brief, Jan., '98).

Sodium tellurate, first used by Neusser, of Vienna, given to 51 patients in doses of about 3 grains; it controlled the sweats without exciting any untoward effects. It is a white powder, soluble in water and alcohol, and is eliminated by the kidneys and lungs, and imparts to the breath a garlicky odor: the only drawback to its use. In severe cases two doses of 4 grains each may be given in pill form. Barié (Jour. des Prat., Feb. 17, 1900).

HÆMORRHAGES, OR HÆMOPTYSIS. — Ice to the chest; absolute rest in bed; a brisk cathartic, followed by periodical hypodermics of morphine sulphate and atropine combined, or atropine alone, is the treatment *par excellence* in all cases in ordinary practice; ergot is of doubtful value, and the same may be said of eating cracked ice, which simply keeps throwing more liquid into the circulation; in severe hæmorrhages, if the above remedies fail to produce the required result, it may become necessary to apply ligatures or bandages to one or all extremities. In hospital and sanitarium practice, also in large cities, we have available a much more certain and safe remedy in the compression of the lung by gas injected directly into the pleural cavity; in profuse hæmorrhages, where the pressure need be only temporary, oxygen-gas as found in the markets will be all that is required, as ere it is absorbed a clot will probably form.

In those cases in which slight and oft-repeated hæmoptysis is present, a more lasting pressure is required, and injections of nitrogen-gas are indicated, as this substance remains unabsorbed in the pleural cavity until removed; the effect of these injections is immediate and completely satisfactory. Rest in bed thereafter is not necessary after hæmoptysis, and only for a short time in hæmor-



rhages of more or less severity. (See also PULMONARY HÆMORRHAGE, volume v.)

Hæmorrhage will subside spontaneously in nine out of ten cases if the patient be put at rest. Cold applications are generally useful, an ice-bag being applied over the heart or over the seat of bleeding, if that can be located without undue disturbance to the patient. Cold food only is to be given, and in small quantities. Use of the voice is to be interdicted, and laxatives should be given to prevent straining at stool. When necessary, the force of the heart's action can be reduced by aconite in appropriate doses, and cough be checked by opium, codeine, or morphine. It is possible that heroin may serve better than the natural morphine. In severe cases morphine may be given hypodermically up to the point of tolerance. The most generally useful drug to promote coagulation of the blood and the formation of permanent clot sealing the wound in the vessel or vessels is crystallized calcium chloride. S. Solis-Cohen (Jour. Amer. Med. Assoc., Feb. 23, 1901).

**SEMISPECIFICS AND ANTISEPTICS.**—The profession is still searching for a specific for this disease. Iodine, menthol, cinnamic acid, oil of cloves, cod-liver-oil, peanut-oil, nitrate of silver hypodermically and externally, iodide of potassium, euophen, formalin, creasote, guaiacol, ichthyol, kalagua, tuberculin, antitubercle serum, various forms of cold and hot inhalations, and, finally, climate have all been strongly advocated by different observers as exerting a marked inhibitory influence on the progress of the disease.

Probably too much has been expected, or perhaps those attempting to apply the principles advocated by the originators of the several so-called semispecifics, have not sufficiently individualized their patients; hence the disappointment in many instances.

Creasote and its various derivatives are extensively used by the profession;

it is best administered in doses not exceeding 15 drops of Merck's preparation or 5 to 20 drops of creosotal or five to 15 grains of guaiacol three times a day after meals. The liquid form of creasote and its derivatives may be administered in milk, but preferably in capsules of subnitrate of bismuth, 5 drops in each capsule. Creasote may also be administered in capsules containing codliver-oil.

All the forms of medical treatment hitherto employed in the cure of tuberculosis have, by general consent, been discarded. The last vaunted method, that of Landerer, has given him good results in 20 per cent. of the cases of a very mild type. He has, however, discovered a modification of the method, which enabled him to achieve a cure in 8 per cent. of the cases of advanced tuberculosis with cavity formation. He used Landerer's solution of 4 of cinamate of soda to 100 of water, but employs the solution hypodermically instead of intravenously. He can thus give doses of 10 to 20 times the amount, without ill effect. He begins with 3 cubic centimetres and increases up to 20 cubic centimetres daily, which represents the normal dose. He has, however, given 70 cubic centimetres in bad cases without ill effect. The improvement in the symptoms is prompt, and affects first the fever and the marasmus, then the cough. At the end of three months the bacilli have generally disappeared from the sputum. They may persist, however, as long as five or six months. All of the cases which resulted fatally in spite of this treatment presented previous involvement of the gastrointestinal tract, amyloid, etc., and died, not of tuberculosis, but of marasmus. A. S. Herrera (International Medical Congress; Medical News, May 23, 1903).

Cinnamic acid and oil of cloves are also used; the latter is administered in doses of from 5 to 40 drops, the amount being increased daily until the limit is reached or until the patient becomes so thoroughly saturated with the drug that

the odor is apparent when he enters the physician's office. Cinnamic acid is a favorite drug of some physicians, but it is not so well tolerated by the stomach as the oil of cloves.

Ichthyol is, perhaps, the most valuable drug we possess in treating all cases of pulmonary tuberculosis presenting mixed infection. The best results are obtained from the administration of large doses, and if the drug is given in such form as to pass the stomach undissolved, amounts of 30 grains, three times a day, are easily borne and untoward effects are few. An occasional diarrhœa or an attack of vomiting which is preceded by the taste of ichthyol may occur. These symptoms quickly subside upon the withdrawal of the drug, and with its resumption the dose which caused the above symptoms can usually be given without further trouble.

The improvement is rapid, and within one month, in individual cases, where other beneficial factors are eliminated, there may be a gain in weight of eight or ten pounds, and in those patients whose weight had, previously, and under different surroundings, remained stationary for long periods of time. There is improvement in general nutrition, as evidenced in females by return of menstruation. The fever, sweats, and cough diminish, the sputum is more easily brought up, is smaller in quantity, and is changed in character. In some instances expectoration is too quickly reduced, and patients experience difficulty in raising the sputa. In cases far advanced, those having a cavity, with excessive expectoration when ichthyol acts well, the effect is striking, and it is more suggestive of the important part played by secondary infection in tubercular processes.

Ichthyol changes the character from the foetid, decomposed, purulent sputum into that which is mucoid and frothy, ameliorates the symptoms of fever, chills, sweats, and general failure of nutrition dependent upon the absorption of pus-products, so that it may be said that in such cases ichthyol practically accomplishes drainage, and, what is more important, tends to convert the function of the pyogenic membrane into one which secretes mucus instead of pus. The debilitating effect of pus-absorption is put aside, and there is general improvement noted.

Ichthyol has been personally employed in thirty cases of tuberculosis. In incipient stages the cough disappears in a few days. If the lesions are more extensive it may continue for some weeks or even months. Expectations become more liquid and less abundant. All the symptoms are much improved. Twenty to 40 drops of a mixture of equal parts of ichthyol and water should be taken four times daily. A little peppermint may be added. Fraenkel (*La Méd. Mod.*; *Med. News*, Oct. 30, '97).

Ichthalbin has some properties which make it slightly more acceptable to some few patients than ichthyol.

The large daily doses of ichthyol required renders it impossible, on account of the expense, to administer it to some patients, and a good substitute in such instances is kalagua. Kalagua, like ichthyol, changes the character of tuberculous sputa from purulent to mucoid within a short time. It has no deleterious effect on the functions of the stomach. Only small doses, from 4 to 8 grains, three times a day, are required. After more or less continued use of this drug it becomes necessary to occasionally remit its administration on account of temporary exacerbation of the congestion in the diseased area, accompanied by pain and ruder respiration.



Codliver-oil and mixed fats are very valuable when they can be assimilated. Milk, referred to under the heading of diet, may also be properly included among the food medicines. Patients should be forced to consume from two to three quarts daily. There need be but few exceptions to this rule.

For the medical treatment of tuberculosis codliver-oil in doses of 1 or 2 teaspoonfuls twice a day, given in extract of malt, is recommended. Arsenic is superior to iron. The latter increases the tendency to hæmoptysis, and is contra-indicated in the presence of pyrexia. Zinc oxide, in doses of 5 grains, is of value in night-sweats, and for the cough lozenges of licorice and gum acacia. Dry inhalations are also useful in checking cough; a saturated alcoholic solution of menthol or a mixture of equal parts of creasote, guaiacol, and spirit of chloroform may be used. Belladonna and codeine may be given for the relief of excessive secretion. Hector Mackenzie (*Practitioner*, June, '98).

*Antitubercle Serum.*—For the past eight years investigations have been carried on looking toward immunizing patients against tuberculosis, as well as curing them when once infected. Most of our experience in this line of treatment has been with antitubercle serum of the United States Government, from its Biochemic Laboratory at Washington. De Schweinitz claims *to have produced immunity in a few pigs and markedly prolonged the lives of others.*

The use of antitubercle serum would seem to be indicated only in incipient cases and in those presenting a pure culture or simple infection. This, of course, refers to those cases which we hope to succeed in curing. In the writers' experience it has seemed, in a few advanced cases, to retard temporarily the progress of the disease; it decreased temperature and increased materially the strength of the patients.

Generally speaking, the use of anti-tubercle serum would seem to be contra-indicated in the third stage of tuberculosis, marked cases of softening or excavation, those of marked hereditary taint, in cases presenting a very rapid heart-action with relative feebleness of arterial pressure, and in those in whom corpulence, vital capacity, and conformation of the chest are much below the normal standard; also in cases presenting marked mixed infection.

There is but little, if any, danger attendant upon the administration of serum if the proper precautions in the way of antisepsis are observed. Urticaria, erythema, and other forms of eruptions; painful swellings at the point of injection; stiffness, pain, and sometimes swelling in the different joints, especially in patients presenting rheumatic histories; enlargement of the axillary gland, and myalgia are met with in a small percentage of cases. These symptoms, however, are not dangerous, but annoying, and, even in the small number of cases who present them, are seldom repeated during subsequent treatment.

The advantages of serum treatment are: first, it does not tax the functions of digestion or produce gastritis, diarrhoea, or loss of appetite. Secondly, in cases wherein bacilli have disappeared *they have been lost while the sputa were still present.* There may be a certain immunity established in patients treated with serum, but it has not yet been proved.

By a judicious selection of the cases and a careful use of tuberculin-R no harm will be done, but apparently no striking or specific effects are to be looked for. Huber (*Berl. klin. Woch.*, Feb. 14, '98).

Tuberculous toxins do produce some immunity to their own action, but this does not last, nor does it protect

against future invasions of the disease by living tubercle bacilli. If even such susceptible animals as rabbits, however, are inoculated first with attenuated cultures until there is no reaction to tuberculin, and then with virulent cultures of tubercle bacilli, a state was induced in which the animal acquired a resisting power against tuberculosis. Though the disease developed after the inoculation the animal tissues were able after a time to bring about a resolution of the lesions and true cure followed. Where actual cure did not take place, a prolongation of life at least three times that of control animals was obtained. The writer showed the specimens of lungs of rabbits, exhibiting the marked tendency to complete resolution in experimentally immunized animals. He concludes, therefore, that the evidence tends to show that the attainment of a certain degree of toxin immunity does not protect against reinfection, and that whatever degree of immunity has been obtained experimentally is due rather to a bacteriolytic, or what Behring refers to as isopathic immunity. A living germ seems necessary to the production of whatever degree of immunity has already been attained experimentally. E. L. Trudeau (Proceedings Association of American Physicians; Medical News, May 16, 1903).

*Antistreptococcic Serum.*—This serum is indicated in low altitudes where streptococci are present at all abundantly in the sputa. After one or two injections of 10 cubic centimetres each, the germs disappear temporarily. At altitudes of two thousand feet or more these germs disappear under climatic influences alone. The United States Government is now experimenting with a view to producing a serum that shall be antagonistic to both the tubercle bacillus and the streptococcus.

*Inhalations.*—Hot-air inhalations are used extensively and more or less successfully when troublesome cough or profuse expectoration are present. Com-

bined with oxygen, these inhalations give great relief in many cases of pleurodynia and asthmatic dyspnoea. Hæmoptysis and scanty expectoration would seem to be contra-indications for their use.

The temperature of the inhaler should range between 300° and 400° F., and the drugs most advantageously employed are ichthyol, creasote, camphor, eucalyptus, turpentine, tar, origanum, and menthol.

Moist, hot inhalations are useless, if not absolutely harmful.

Cold, moist inhalations as generated by a multinebulizer are of undoubted value in cases of mixed infection and cavitation; the drugs mostly used in the nebulizer are creasote, oil of pine, menthol, eucalyptus, tr. benzoin, camphor, albolene, tar, carbolic acid, extract of balm of gilead, etc.

Both forms of inhalations mentioned are also useful as inducing deep breathing.

*Hydrotherapy.*—In the past few years hydrotherapy has assumed an important place in the treatment of pulmonary tuberculosis. The expense attached to the installation of a proper plant and to its administration are too great to admit of its use in private practice. It promises, however, to become, year by year, of greater value as one of the recognized treatments of this disease in sanitariums.

The outfit consists of a table containing apparatus for applying various forms of douches to different portions of the body, bath- and sitz- tubs, hot-air cabinets, massage-tables, hot- and ice- water tanks, weighing scales, etc.

*Exercise.*—There is too great a tendency toward absolute rest in the treatment of phthisis. The key-stone of successful treatment is conserving and



building up the physical resources of the patient by climate, hygiene, diet, and an out-of-door life. Up to the present time all other agencies employed must properly be termed auxiliaries, the aim being to build up a solid physical condition, a hardy, resistant one.

Exercise, prudently carried out, is essential. All incipient tuberculars whose temperatures range below 100° F. should exercise freely and systematically. Where tachycardia or dyspnoea exists, the amount of exercise should be regulated by the physician.

**TREATMENT OF COMPLICATIONS IN THE UPPER AIR-PASSAGES.**—It is astonishing how large a percentage of even incipient cases of pulmonary tuberculosis present lesions of more or less severity in the upper air-passages, and it is a question whether quite a number of patients may not attribute their trouble, primarily, to conditions of the nose or pharynx, which have, by reflex irritation, created a *nidus* for pulmonary infection.

It should be the invariable practice to examine the naso-pharynx and larynx of all tubercular patients the first time they are seen, whether or not there be subjective symptoms leading to the suspicion of disease of these parts. By these routine examinations, cases of chronic congestion or infiltration of the arytenoids are discovered early enough to be easily cured in nearly every instance by prompt local treatment. Unrecognized and left to themselves and climate, such cases, at least in a fair majority, either lead to fatal laryngeal conditions or are the indirect cause of prevention of cure of incipient pulmonary lesions.

Statistics show that not less than 25 per cent. of persons suffering from pulmonary tuberculosis have more or less involvement of the larynx and naso-

pharynx. (See TUBERCULOSIS OF THE LARYNX.)

The naso-pharynx should be put in the best possible condition by frequent spraying with albolene solutions, followed by sprays containing such applications as may be individually indicated. Polypi must be removed; hypertrophic mucosa or turbinated bones may be reduced by fused nitrate, chromic acid, or suprarenal extract. Excrescences of a bony nature must be removed by operation. Slight laryngeal congestions yield readily to a cleansing spray, followed by a solution of alumnol, 10 to 20 grains to the ounce, or silver nitrate, 4 to 10 grains to the ounce. Chronic congestion and infiltration require, besides the cleansing by Dobell's solution, a local application of strong alumnol, of the strength of 25 to 50 per cent.; lactic acid, 20- to 25-per-cent. solution; silver nitrate, 30 grains to the ounce, or the fused crystals. For ulcerations, good results may be attained by a spray of hydrogen peroxide, 50 per cent., followed by Dobell's to remove secretions. After this a direct application of either lactic acid, 20 to 25 per cent., or Chappell's creasote mixture. Sluggish granulations should be stimulated by fused nitrate.

Mucous tags remaining after removal of papilloma disappear under treatment with suprarenal extract. Tracheal ulcerations do well with intratracheal injections of argonin, 5 grains to the ounce, or a weak solution of silver nitrate.

**SANITARIUM TREATMENT.**—It is a conceded fact that, when possible to obtain admission to a properly-conducted and scientific sanitarium, the tuberculous improve more rapidly, and that the ultimate prognosis is more favorable than when treated under the best possible environment outside. Sixty-eight per cent. of wise and 38 per cent. of un-

wise patients recover from phthisis. Dr. Solly says: "Dr. Trudeau, Dr. Von Ruck, and Dr. Bowditch all believe that they can obtain better results, other things being equal, in the sanitarium than outside. My own personal experience in sanitarium treatment, though not sufficient to furnish statistics, confirms the opinion; and I believe the great hindrance in all climates to getting better results is due to the mistaken repugnance of most well-to-do patients to enter sanitariums, and to the criminal apathy of the State in neglecting to fur-



Ideal arrangement for out-of-door treatment.  
(S. A. Knopf.)

nish them to the poor, so that their use is extremely limited. My observations as to the influence of prudence upon the prognosis of phthisis corroborate these opinions of the value of sanitariums."

Social surroundings, wise amusements, properly-arranged diet, hygienic surroundings, methods of prophylaxis and intelligent care are all to be found in a more perfect condition in sanitariums than elsewhere.

From an analysis of the cottage sanitarium treatment of incipient tuberculosis as instanced by the Adirondack institution in New York, it is concluded that (1) tuberculosis, if diagnosed in its

early stages, is curable in a large proportion of cases; (2) it is, therefore, of vital importance that diagnosis be made early; (3) the best results in treating incipient tuberculosis are obtainable by the open-air treatment in special sanitariums situated in good climates; (4) the best plan of construction for such sanitariums is the cottage-plan or some one of its modifications. E. L. Trudeau (Practitioner, Feb., '99).

In 95 per cent. of the cases of consumption seen by physicians the patients are unable to afford treatment away from their homes. Arrest or cure of tuberculosis is a question entirely of nutrition, and, of the measures by which the general nutrition of the body may be encouraged, the first and most important is fresh air. The following directions for home-treatment are given: The almanac is to be taken and the hours of sunshine counted. In winter two hours are to be cut off in the morning and one hour in the evening, and for the remainder of the day the patient must be out-of-doors. If there is no possible arrangement for life out-of-doors, the patient must be put in a room with southern exposure, and the bed moved into the sunshine, with the windows wide open. If there is a balcony or veranda with a good outlook toward the south it should be arranged for the patient; if not, a shelter can be put up in the yard at a very moderate cost. On a well-padded lounge covered with a couple thicknesses of blankets the patient sits or reclines all day. Only on blustering, stormy, or very rainy days is the patient to remain in the house. No degree of cold is a contra-indication. This continuous open-air life at rest is the most powerful influence possessed to-day against the fever of tuberculosis. In any long series of cases the patients who do well are those who take plenty of food. Each case must be dealt with separately, but as large a quantity of food as possible should be given even, when possible, insisting on overfeeding, or stuffing. For some time personal patients have been urged to accustom themselves to take raw eggs, beginning with 1 three times a day, and increasing until



they can take 20 to 24 a day. If broken into a cup and sprinkled with a little pepper and salt, the egg can be readily swallowed without breaking the yelk. Osler (*Phila. Med. Jour.*, Nov. 25, '99).

**Ideal rest-cure arrangement:** From a large beach-chair of wicker-work the seat is removed and the inner walls are lined with padding. A reclining-chair is placed with its back in the interior and the whole arranged so that the patient is protected from the wind and sun. There the patient installs himself for the day. S. A. Knopf (*Medical Record*, Jan. 27, 1900).

The essentials of the sanitarium treatment are: A continuous supply of fresh air with no unnatural changes of temperature and the avoidance of all sources of irritation from dust and the like; good, nourishing food in sufficient quantity to establish and to maintain the normal body-weight of the patient; an absolutely regular life, so arranged that neither the lungs nor any portion of the body are allowed to be put to any strain; and graduated exercise without strain. A. Latham (*Lancet*, Aug. 16, 1902).

**Prophylaxis.**—Prophylaxis is difficult in this disease, for the predisposing factors are numerous and often hidden. Marriage-laws prohibiting the union of physically debilitated persons would be of value, but at present are impracticable. Careful oversight of weakly children, or apparently healthy offspring of parents of suspicious physical ancestry, especially at certain periods of life, would do much toward removing the possibility of the inception of the tubercle bacillus. The children in the common school should be taught, and the public should be educated sufficiently, by means of tracts and circulars on the laws of hygiene and infection to enable them to protect their immediate persons and homes. Once having been taught these laws, the public should be forced to observe them.

It is generally assumed that among the sources of tuberculous infection is

the transmission of the germs of the disease from tuberculous animals to man. In order to decide this question experiments were personally carried out during the last two years with Professor Schutz, of the Veterinary College in Berlin. A number of young cattle which had stood the tuberculin test, and might, therefore, be regarded as free from tuberculosis, were infected in various ways with pure cultures of tubercle bacilli taken from cases of human tuberculosis; some of them got the tuberculous sputum of consumptive patients direct. In some cases the tubercle bacilli or the sputum were injected under the skin, in others into the peritoneal cavity, in others into the jugular vein. Six animals were fed with tuberculous sputum almost daily for seven or eight months; four repeatedly inhaled great quantities of bacilli, which were distributed in water and scattered with it in the form of spray. None of these cattle (there were nineteen of them) showed any symptoms of disease, and they gained considerably in weight. From six to eight months after the beginning of the experiments they were killed. In their internal organs not a trace of tuberculosis was found. Only at the places where the injections had been made small suppurative foci had formed, in which few tubercle bacilli could be found. This is exactly what one finds when one injects dead tubercle bacilli under the skin of animals liable to contagion. So the animals experimented on were affected by the living bacilli of human tuberculosis exactly as they would have been by dead ones; they were absolutely insusceptible to them.

The result was utterly different, however, when the same experiment was made on cattle free from tuberculosis with tubercle bacilli that came from the lungs of an animal suffering from bovine tuberculosis. After an incubation period of about a week the severest tuberculous disorders of the internal organs broke out in all the infected animals. It was all one whether the infecting matter had been injected only under the skin or into the peritoneal or the vascular system. High fever set in, and the animals be-

came weak and lean; some of them died after a month and a half to two months; others were killed in a miserably sick condition after three months. After death extensive tuberculous infiltrations were found at the place where the injections had been made, and in the neighboring lymphatic glands, and also far advanced alterations of the internal organs, especially the lungs and the spleen. In the cases in which the injection had been made into the peritoneal cavity, the tuberculous growths, which are so characteristic of bovine tuberculosis, were found on the omentum and peritoneum. In short, the cattle proved just as susceptible to infection by the bacillus of bovine tuberculosis as they had proved insusceptible to infection by the bacillus of human tuberculosis.

An almost equally striking distinction between human and bovine tuberculosis was brought to light by a feeding experiment with swine. Six young swine were fed daily for three months with the tuberculous sputum of consumptive patients. Six other swine received bacilli of bovine tuberculosis with their food daily for the same period. The animals that were fed with the sputum remained healthy and grew lustily, whereas those that were fed with the bacilli of bovine tuberculosis soon became sickly, were stunted in their growth, and half of them died. After three months and a half the surviving swine were all killed and examined. Among the animals that had been fed with sputum no trace of tuberculosis was found, except here and there little nodules in the lymphatic glands of the neck, and in one case a few gray nodules in the lungs. The animals, on the other hand, which had eaten bacilli of bovine tuberculosis had, without exception (just as in the cattle experiment), severe tuberculous diseases, especially tuberculous infiltration of the greatly enlarged lymphatic glands of the neck, and of the mesenteric glands, and also extensive tuberculosis of the lungs and the spleen.

The difference between human and bovine tuberculosis appeared not less strikingly in a similar experiment with

asses, sheep, and goats, into whose vascular systems the two kinds of tubercle bacilli were injected.

These experiments are not the only ones that have led to this result. If one studies the older literature of the subject, and collates the reports of the numerous experiments that were made in former times by Chauveau, Günther and Harms, Bollinger, and others, who fed calves, swine, and goats with tuberculous material, one finds that the animals that were fed with the milk and pieces of the lungs of tuberculous cattle always fell ill of tuberculosis, whereas those that received human material with their food did not. Comparative investigations regarding human and bovine tuberculosis have been made very recently in North America by Smith, Dinwiddie, and Frothingham, and their result agreed with the above.

Considering all these facts, it may be maintained that human tuberculosis differs from bovine, and cannot be transmitted to cattle.

But, now, how is it with the susceptibility of man to bovine tuberculosis? It is impossible to give this question a direct answer, because the experimental investigation of it with human beings is out of the question. Indirectly, however, one can try to approach it. It is well known that the milk and butter consumed in great cities very often contain large quantities of the bacilli of bovine tuberculosis in a living condition, as the numerous infection experiments with such dairy products on animals have proved. Most of the inhabitants of such cities daily consume such living and perfectly virulent bacilli of bovine tuberculosis, and unintentionally carry out the experiment which one is not at liberty to make. If the bacilli of bovine tuberculosis were able to infect human beings, many cases of tuberculosis caused by the consumption of alimenta containing tubercle bacilli could not but occur among the inhabitants of great cities, especially the children. Most medical men believe that this is actually the case.

In reality, however, it is not so. That a case of tuberculosis has been caused



by alimenta can be assumed with certainty only when the intestine suffers first—that is, when a so-called primary tuberculosis of the intestines is found. But such cases are extremely rare. Among 933 cases of tuberculosis in children at the Emperor and Empress Frederick's Hospital for Children, Baginsky never found tuberculosis of the intestine without simultaneous disease of the lungs and the bronchial glands. Among 3104 necropsies of tuberculous children, Biedert observed only 16 cases of primary tuberculosis of the intestine. It is by no means certain that these few cases were due to infection by bovine tuberculosis. It is just as likely that they were caused by the widely-propagated bacilli of human tuberculosis, which may have got into the digestive canal in some way or other. Hitherto nobody could decide with certainty in such a case whether the tuberculosis of the intestine was of human or of animal origin. Now one can diagnose them. All that is necessary is to cultivate in pure culture the tubercle bacilli found in the tuberculous material, and to ascertain whether they belong to bovine tuberculosis by inoculating cattle with them. For this purpose, subcutaneous injection, which yields quite specially characteristic and convincing results, is recommended.

Though the important question of whether man is susceptible to bovine tuberculosis at all is not yet absolutely decided, and will not admit of absolute decision to-day or to-morrow, one is nevertheless already at liberty to say that, if such a susceptibility really exists, the infection of human beings is but a very rare occurrence. It is estimated that the extent of the infection by the milk and flesh of tuberculous cattle, and the butter made of their milk, as hardly greater than that of hereditary transmission, and therefore it is not deemed advisable to take any measures against it.

So the only main source of the infection of tuberculosis is the sputum of consumptive patients, and the measures for the combating of tuberculosis must aim at the prevention of the dangers

arising from its diffusion. Robert Koch (Brit. Med. Jour., July 27, 1901).

Opinions varied as to the frequency with which the transmission of tuberculosis from one species to the other occurred, but practically never within the last eighteen years regarding the possibility and probability of such reciprocal infection. What are the grounds upon which we are asked to discard convictions that appeared to rest on such a solid basis? He endeavors to state them briefly, as he understands Professor Koch's train of reasoning: 1. The bacilli found in cases of bovine tuberculosis are much more virulent for cattle and other domestic quadrupeds than the bacilli found in cases of human tuberculosis. 2. This difference is so marked and so constant that it may be relied upon as a means of distinguishing the bacilli of bovine tuberculosis from those of the human disease, even assuming that the former may occasionally be found as a cause of disease in man. 3. If bovine bacilli are capable of causing disease in man, there are abundant opportunities for the transference of the bacilli from the one species to the other, and cases of primary intestinal tuberculosis from the consumption of tuberculous milk ought to be of common occurrence. But post-mortem examination of human beings proves that cases of primary intestinal tuberculosis are extremely rare in man, and therefore it must be concluded that the human subject is immune against infection with the bovine bacilli, or is so slightly susceptible that it is not necessary to take any steps to counteract the risk of infection in this way.

Now, it may be submitted that at least one of the premises contained in this argument is not well founded, that the others have little or no bearing on the question, and that there still remain reasonable grounds for regarding tuberculous cows' milk as distinctly dangerous to human beings.

It cannot be denied that what may be called bovine tubercle bacilli are, as a rule, distinctly more virulent for cattle and other domesticated animals

than are human bacilli, or that the results of experiments indicate that in natural circumstances there is little danger of cattle becoming infected from human beings. But it cannot be admitted that the low virulence of human bacilli for cattle proves, or even makes it probable, that bovine bacilli have only a feeble pathogenic power for man. That might have been held to be probable if it had been shown that bovine bacilli were very virulent only for cattle; but since it is well established that these bacilli are highly dangerous for such diverse species as the rabbit, horse, dog, pig, and sheep, and, in short, for almost every quadruped on which they have been tried, it appears to be highly probable that they are dangerous to man. At any rate, it is impossible to cite any ascertained fact relating to other bacterial diseases that makes the contrary conclusion probable. It is well known that the majority of the disease-exciting bacteria are harmful to only one or two species, but all those that are common to all the domesticated animals are also pathogenic to man.

With regard to the view that the difference between human and bovine bacilli in respect of virulence for cattle is of such a fixed and constant character that it may be relied upon to distinguish the one from the other, it need only be said that that is very far from being proved.

The evidence in favor of the view that the ingestion of tuberculous milk is one of the causes of human tuberculosis includes a number of recorded cases in which the relationship of cause and effect appeared to be obvious.

The inhalation of tubercle bacilli expelled from the bodies of human patients is doubtless the great cause of human tuberculosis, and every practicable means of preventing infection in that way ought to be employed; but, at the same time, one ought not to concede to the milkmen the right to sell to us tubercle bacilli, even if one were assured that—like Professor Koch's experimental pigs—one had nothing to fear beyond the development of "little nodules here and there in the lymphatic

glands" of one's necks and "a few gray tubercles" in one's lungs. John McFadyean (*Lancet*, Aug. 3, 1901).

It has been shown, in the most unmistakable way by many feeding experiments conducted under the auspices of the Pennsylvania State Live-Stock Sanitary Board that, contrary to the early beliefs, animals fed tubercular materials may develop primary tuberculosis and, in some instances, fail to show lesions in any other organ. It is strange that Professor Koch failed to observe the importance of this point, for in his address he says: "Among the animals (swine) that have been fed with sputum no trace of tuberculosis was found, except here and there little nodules in the lymphatic glands of the neck and, in one case, a few gray nodules in the lungs. In these cases the animals were infected by feeding, but did not develop tuberculosis in the intestines first, or at all." A little later he says: "The animals that had eaten bacilli of bovine tuberculosis have, without exception (just as in the cattle experiment), severe tubercular diseases, especially of the lymphatic glands of the neck and of the mesenteric glands, and also *extensive tuberculosis of the lungs and spleen*." Here, again, is pulmonary tuberculosis from feeding, complicated, it is true, by disease in other organs; but who could say, without knowledge of the history, by what channel the bacilli entered?

The whole question, therefore, is strictly bacteriological, the question being: Is the bovine tubercle bacillus virulent for man?

The work that has been done in this country shows very clearly that for experimental animals tubercle bacilli from cattle are in all cases as virulent and usually very much more virulent than tubercle bacilli from man. The animals used in these comparisons include herbivora and carnivora and species that are resistant, as the horse, goat, rabbit, and dog; and species that are vulnerable, as the guinea-pig, cat, swine, and cattle.

In the face of the fact that the bovine bacillus is so constantly more virulent



than the human bacillus for experimental animals of so widely different species and habits of life, it does not seem safe to conclude because the human bacillus is not especially virulent for cattle that the bovine bacillus is non-virulent for man. Koch has said that this question could be settled positively only by the impossible expedient of inoculating a person with bovine tubercle bacilli. But it has happened that such inoculation has already occurred accidentally in several instances. A number of men have contracted tuberculosis and several have died from infections sustained in making post-mortem examinations on tubercular cattle. These accidental cases show, beyond peradventure, that the bovine tubercle bacilli may, under some conditions, be virulent for man. Leonard Pearson (*Phila. Med. Jour.*, Aug. 3, 1901).

While experimentally infection in an animal may be caused by material taken from a man, this method of infection may, for practical purposes, be neglected. Tuberculosis inflicts grave losses upon the animal industry and may spread from animals to man. It is less frequent among cattle in the West than in the East, where cattle are more in-doors. When introduced into a herd tuberculosis spreads rapidly. As the cattle industry has thrived bovine tuberculosis has grown in importance. It affects the greatest American industry, in a commercial and monetary way. Advanced stages render milk unfit for human consumption. Thus far but 1 per cent. of the diseased animals have been killed, on account of the expense. Slightly infected animals should be isolated; all advanced cases killed. When meat is not eaten raw, there is no danger from the ingestion of tuberculous meat. Milk containing bovine tubercle bacilli may cause tuberculosis in children and young, susceptible individuals. But this is uncommon. Milk containing bovine tubercle bacilli should not be used as food, nor should any milk containing microorganisms be sold. J. G. Adami (*Boston Med. and Surg. Jour.*, June 5, 1902).

Two personal cases of mesenteric-gland

tuberculosis. One proved by bacteriological tests to be from bovine bacilli, the other from the bacilli of human tuberculosis. In these cases the infection was evidently from the intestinal tract, and the one positive case shows the liability to human infection by bovine tubercle bacilli. A cow was inoculated with cultures from the two cases. The bovine bacillus grew well in the animal's tissues. The human bacillus failed to grow. There was some slowness of growth on the part of the bovine bacillus evidently due to attenuation of virulence in human tissues. Two almost similar cases of mesenteric tuberculosis proved to give cultures of bacilli of the human type, so that out of four cases only one seemed due to infection from tuberculous meat or milk. There is no macroscopical difference between the lesions due to the bovine and the human bacilli. In the caseating glands in which the bovine bacilli were found there were large numbers of bacilli, while very few in those due to a human infection. Dr. Ravenel, of Philadelphia, has reported a case of human mesenteric-gland infection also due to bovine bacilli. Theobald Smith (*Proc. Assoc. of Amer. Phys.; Medical News*, May 16, 1903).

At the present time the weight of the available evidence is in favor of the view that the chief source of infection, in children as well as in adults, is the human tubercle bacillus, and that the portal of entry is the respiratory tract. It has, however, been proven conclusively that the bovine tubercle bacillus is responsible for a certain proportion of the deaths from tuberculosis in children, and there is strong evidence at hand to show that the number of children infected from bovine sources is quite large. Whether the number be large or small, it is none the less our duty to guard against the use of milk from tuberculous cattle for food. We will still fail in doing our whole duty if we neglect to guard against food products from tuberculous animals and to make every effort for the eradication of tuberculosis from cattle. M. P. Ravenel (*Montreal Medical Journal*, June, 1904).

The disease having been developed, there should be a partial isolation of the patient; we use the word partial advisedly, for great injustice is done daily to sufferers from phthisis by panic-stricken friends and relatives. If possible the patient should, in order to insure recovery and to remove every possible source of danger to others, be sent to a sanitarium; when this is not possible, or if the disease be in the incurable stage, the patient should be given a separate sleeping apartment and should avoid kissing or fondling members of the family; all dishes used should be sterilized after each meal, and, finally, all sputa should be gathered in a proper receptacle and cremated.

The following rules are useful, both to the consumptive and to his friends:—

1. Expectoration, in-doors, should be received into small paper bags and afterward burned.

2. Expectoration, out-of-doors, should be received into a suitable bottle, to be afterward washed out with boiling water, or into a small paper handkerchief, which is afterward burned.

3. If ordinary handkerchiefs are ever used for expectoration, they should be put into boiling water before they have time to become dry, or into some disinfectant solution to be ordered by the doctor.

4. Wet cleansing of rooms, particularly of bedrooms occupied by sick persons, should be substituted for "dusting."

5. Sunlight and fresh air are the greatest enemies of infection. Every consumptive should sleep with his bed-room window open, top and bottom, and during the day should occupy a well-ventilated room. Rebreathed air is the main cause favoring consumption. If the patient is warmly clad he need not fear keeping out-of-doors in any weather. (N. B.: The patient himself is the greatest gainer by the above precautions, as his recovery is retarded and frequently prevented by renewed infection derived from his own expectoration.)

6. Persons in good health have no

reason to fear the infection of consumption. Overfatigue, intemperance, bad air, and dusty occupations favor consumption. Gilbert Gordon (Canada Lancet, June, '99).

J. EDWARD STUBBERT,

JOHN D. RICHARDS,

Loomis Sanitarium,

Liberty, N. Y.

## TUBERCULOSIS OF THE SKIN.

Under this head will be included the cutaneous affections in which bacillus of tuberculosis has been found. These may be subdivided into four main varieties: *true tuberculosis*, *miliary tuberculosis*, *lupus vulgaris*, and *lupus erythematosus*.

**True Tuberculosis.**—This is a form of primary tuberculosis due to contact with tubercular ulceration. It is, therefore, usually found on the lips, the vulva, or anus. It is characterized by small tubercular growths which gradually soften and become the foci of round or oval ulcerations. These are usually covered with sanious purulent discharge retained *in situ* and by the clear-cut edges of ulcers. When this discharge is removed, the bottom of the ulcer is found to be red; if left in place it becomes transformed into a grayish crust. The remedial measures indicated for lupus are also applicable here.

## MILIARY TUBERCULOSIS OF THE SKIN.

—This disease, according to Kaposi, is much more frequently met with than one would be led to suppose from the publications upon the subject, since he has seen twenty-two cases in his clinic and others in private practice. Clinically it is a well-defined disease, to be distinguished from lupus and all other tuberculous affections of the skin. It occurs almost entirely in individuals suffering from some other form of tuberculosis, usually of the lungs, but by no means only in the last months of life of such



persons or in acute miliary tuberculosis of internal organs. Tuberculosis of the skin is very often associated with a like affection of the neighboring membranes, primarily or secondarily. Spontaneous healing may take place or it may follow appropriate local treatment.

Many of the cases are distinctly traceable to autoinoculation, while in some the inoculation seems to have originated from without. Whatever be their origin, they are due to the introduction of the tubercle bacillus into the skin. The cutaneous manifestation is often inaugurated by an intense itching, which the tuberculous patient scratches and probably inoculates. Warty or papillomatous granulations then appear, which spread superficially, become ulcerated, etc., and otherwise assume a character recalling lupus. This form may proceed to spontaneous healing after a few months, and is apt to yield with more promptness to the measures indicated for lupus (*q. v.*).

On July 27, 1901, Dr. G., while performing autopsies on two cows, the subjects of experimental tuberculosis, wounded the flexor surface of one of his wrists. By September 10th there was a nodule in the skin at the seat of the wound, measuring 15 by 8 centimetres. This was excised on September 14th. Portions were inoculated into two guinea-pigs, both of which developed generalized tuberculosis. Sections of the nodule showed the characteristic histological picture of the tubercle and also large numbers of typical tubercle bacilli. Ravenel (University of Penna. Medical Bulletin, Feb., 1902).

### Lupus Vulgaris.

This affection is now recognized as a tuberculous lesion of the skin or mucous membrane, or both, which may proceed to ulceration (*lupus exedens*), observed in young subjects—*i.e.*, from infancy to about the thirtieth year—or not, *lupus exfoliativus*, in which thin scales are

thrown off from the lesion, also a tuberculous one.

**Symptoms.**—In both varieties lupus begins in the form of yellowish-red or copper-colored projections or blotches varying from the size of a millet-seed to that of a split pea. At times these blotches disappear under pressure (*lupus plan*). When in the form of tuberculous nodules, they may, though rarely, become aggregated into patches which, by coalescing, in turn cover extensive surfaces; but, as a rule, they do not; they are indolent, soft, and elastic, and sometimes slightly sensitive to pressure. When they become the seat of several blood-vessels, they assume the form known as the myxomatous lupus, and, when exceedingly vascular, the angiomatic lupus. Their progress is exceedingly slow. When the tubercles break down and ulcerate, they become covered with scabs, overlying a bed of sanious pus; under this the ulceration gradually extends, eating its way in all directions. The neighboring tissues are slightly tumefied, and a narrow, reddish areola is usually present. After a certain time, the ulceration involves the deeper structures, and all tissues—muscular, cartilaginous, tendinous, etc.—are gradually invaded. The mucous membrane of the nose, mouth, pharynx, larynx, and the conjunctiva are often gradually included in the destructive process, and deformities of the nose, mouth, lids, etc., result. Unfortunately, this terrible disease shows a distinct predilection for the face, though it may also develop in the skin of the limbs, buttocks, and trunk. Again, the ulcerative form almost invariably attacks the nostrils, internally or externally, destruction of this organ being but a matter of time unless the disease is mastered.

In the non-ulcerative variety the tu-

bercles remain practically stationary, then flatten out, and leave in their stead a wrinkled surface, which, as stated, becomes exfoliated, and ultimately disappears, leaving in its stead a small cicatrix.

The many forms which lupus may assume have suggested an equal number of subdivisions. When the destructive process advances with great rapidity, destroying everything in its wake, it is termed *lupus vorax*; when the suppuration is slight and the lesion is hard, verrucose, or papillomatous, it is termed *lupus verrucosus* or *papillomatosus*; when the affected tissues are greatly thickened and deformed, it is termed *lupus hypertrophicus*, etc.

All the forms of lupus, with the exception of *lupus vorax*, progress slowly. It may, after a period of slow development, become stationary and even recede until complete recovery is attained. This is rarely observed, however. A peculiarity of the disease is its tendency to become complicated with other cutaneous disorders: erysipelas, adenitis, epitheliomatous cancer, etc.

**Diagnosis.**—Lupus vulgaris may be confounded with tertiary syphilis, epithelioma, rodent cancer, and scrofuloderma. The syphilitic eruption most likely to be mistaken for lupus is a subcutaneous gumma, which after a time ulcerates and becomes covered with a scab; this heals and others form just beyond, advancing in a serpigenous manner. A scar is formed which resembles lupus, except that there is pigmentation around the patch, and the cicatrix is thinner, softer, and less fixed than lupus.

Epithelioma is more painful, progresses more rapidly, and is liable to hæmorrhages; lymphatic glands in the neighborhood and the deeper structures are invaded. The edges of the ulcer, too,

are raised and hard. Rodent cancer arises late in life, the edges of the ulcer contain no nodules; and there are no granulations on the ulcer. It is always single, and does not cicatrize spontaneously. (Bidwell.)

**Pathology.**—Walker divides the commoner varieties of lupus into three forms: 1. The ulcerating form, which is most common on the face; the affected area is covered with granulations, giving rise to a purulent discharge, which dries up into a crust. The granulations of this form differ from the granulations of an ordinary ulcer in that they are covered by epidermis. The epithelial cells are swelled, degenerative, and allow the passage of serum and leucocytes. This is due to the secondary inoculation of organisms other than the tubercle bacillus. 2. The form in which no ulceration occurs, a miliary tuberculosis of the skin, which presents multitudes of little tubercle-follicles which constitute the apple-jelly nodules. If a sufficient number of nodules run together, the epidermis is lost, and the area, becoming inoculated with other organisms, gives rise to the form of the disease just mentioned. 3. The fibrous form, in which the patch is usually single, and varies in size from a sixpence up to six inches in diameter. The skin is thickened and red and often scaly. No tubercle can be made out on account of the diffuse redness which masks them.

**Prognosis.**—The recent contributions to our knowledge of lupus have somewhat improved the chances of recovery; but the disease remains a difficult one to overcome, and sometimes seems to baffle all efforts. Again, it may apparently yield to appropriate treatment and suddenly reappear—all features which should suggest reserve when the physician is asked to express his views.



**Treatment.**—An important feature of the treatment of lupus vulgaris is attention to the general health. It is a tuberculous affection and, therefore, associated with general vital depravity. Out-of-door exercise, wholesome food, tonics, etc., tend greatly to assist the local measures by increasing the powers of resistance of the tissues to bacillary invasion.

The reports of numerous operators have shown that many cases of lupus can be cured by radical excision and with good cosmetic results. This mode of treatment should be undertaken at the earliest possible moment. The incision should be made in healthy tissue, at least 1 to 2 centimetres from the infected area, and the tissues thoroughly curetted off. A. Buschke (Berl. klin. Woch., No. 21, '98) states that if there is any doubt as to how far the tissues are infected, the tuberculin test should be employed. A plastic operation, to cover the defect, should then be resorted to.

**SURGICAL TREATMENT.**—The following procedure has been practiced in thirty-five cases of lupus in Lang's clinic in Vienna. Most of the operations were done under local anæsthesia. An incision is made all round the affected tissues about one-half inch beyond the margin, and the diseased portion of skin is dissected up, very great care being taken to avoid leaving behind any of the tissues affected with lupus. The wound is covered with Thiersch grafts, taken chiefly from the outer side of the thigh. A piece of dry aseptic gauze is then placed on the part and fixed with collodion. This is left untouched for four or five days, then dressed in the same way and left for the same length of time, and then an ointment may be applied.

Cicatricial contraction may lead to some deformity; but, if this occurs, nothing should be done until after the lapse

of several months, when the contraction has reached its maximum. Seven of the patients were under observation for various periods ranging from eighteen months to four years after treatment had ceased, and no recurrence took place, and many others a shorter time with an equally good result; but in four cases a rapid return occurred. C. Popper (Derm. Zeit., vol. iv, Parts 1 and 2, '97).

**TUBERCULIN.**—Koch's new T-R tuberculin has been used with considerable success by several dermatologists. Koch advises that a small dose ( $\frac{1}{500}$  milligramme) be first used, and that this be as rapidly increased as possible, avoiding any constitutional reaction, and not repeating the injection until the temperature has fallen to the normal point or near it. Twenty milligrammes should constitute the dose to be reached if possible.

Up to a certain point tuberculin T. R. has a beneficial influence on lupus vulgaris. Its greatest benefit is seen in the ulcerative forms of the disease, while in the nodular forms its effects are trifling or negative. Local injections apparently give better results than those applied to a distance from the diseased area. In order to secure a permanent result, the use of tuberculin T. R. should be followed by the prolonged administration of thyroid extract. The drawbacks of the treatment are (1) the expense and (2) the length of time required. Crocker Brit. Med. Jour., Oct. 25, 1902).

In four cases in which the new tuberculin was used Leslie Roberts (Brit. Med. Jour., Jan. 15, '98) noticed that the effect was most marked when the lymph- and blood- vessels most actively participated in the tuberculous process. In the dry, non-irritative form of the disease, when the tuberculous nodules seemed to be more or less isolated by inert disease, the improvement was far less obvious. The local changes consisted in shrinking of

the tissues in the immediate vicinity of the tubercles, and in an arrest and healing of ulceration. The reduction of oedematous swelling of the lips and gums was very remarkable.

Tuberculin gradually applied is never hurtful, and it is useful in resolving lupous or tuberculous infiltrations of long standing. Before applying tuberculin, it is necessary to get rid of any septic phenomena which may be present. The use of the thermocautery at the same time is advisable to destroy any nodules as soon as they appear. Campana (Il Policlinico, Feb. 1, '98).

When the above means cannot be resorted to, lactic acid is probably the best agent at our disposal. The crust having been, if possible, removed, the parts are sprayed with a 4-per-cent. solution of cocaine, and the edges, after three or four minutes, are carefully moistened with the acid, using a small cotton pledget or a camel's-hair pencil for the purpose. Galvanocautery may be used, but it is, as a rule, more objectionable to the patient. Lysol applied pure has been recommended. The thyroid preparations have recently been tried with apparent success, but in doses which appear, at least, dangerous.

Good results with thyroid extract in two cases of lupus. By degrees one case took as much as 75 grains; the other 90 grains daily, but later about 15 grains was the dose administered. Treatment was continued over a period of eight months, both cases then being absolutely well. F. G. Proudfoot (Brit. Med. Jour., Jan. 2, '97).

N. R. Finsen (Sem. Méd., No. 59, '97) has recently obtained good results by means of a simple apparatus: the rays—either sunrays or electric arc-rays—concentrated on patches of lupus.

Professor Finsen has further developed his "phototherapeutic" method of treating this disease, and the results ob-

tained have proved encouraging. The bactericidal influence of light-rays has long been known, but the mode of utilizing them advantageously required development, and this feature has received Finsen's attention. Not only sunlight, but artificial light, was found to possess the quality mentioned; but the rays had to be rendered harmless, the bactericidal properties residing in the chemical rays, especially in the ultra-red (heat) rays and ultraviolet, and giving rise to inflammation when merely concentrated by means of lenses upon the skin. The heat-rays involved had therefore to be excluded. In the perfected electric-light apparatus this is accomplished, according to H. W. Stelwagon (Univ. Med. Mag., Dec., 1900), "by filling in the space between two of the lenses in the lens-tube with distilled water, and, in order to prevent this from becoming overheated, surrounding this section with an enveloping tube or jacket through which cool water is kept running. The sun-condensing apparatus consists of a band of metal with glass on each side properly adjusted to form a lens; the space between these two glasses is filled with water colored with an ammoniacal solution of copper sulphate. The heat-rays are further controlled, in both plans, by a disk with glass ends, through the central hollow part of which cool water is constantly circulating; this is placed over the part being treated. This disk has still another very essential purpose: Finsen found that the blood in the part was in itself an obstacle to the deep penetration of the chemical rays, to remove which this transparent disk is kept firmly pressed down upon the surface treated, and the light projected through it.

The immediate effect upon the small area treated is slight, but after a few hours the part becomes erythematous, swollen, puffy, and tender; a small vesicle or bullæ may appear. A small portion of the diseased surface being treated at each sitting, and the same part requiring sometimes two or three exposures, the method is somewhat slow; but it is effective, and the light



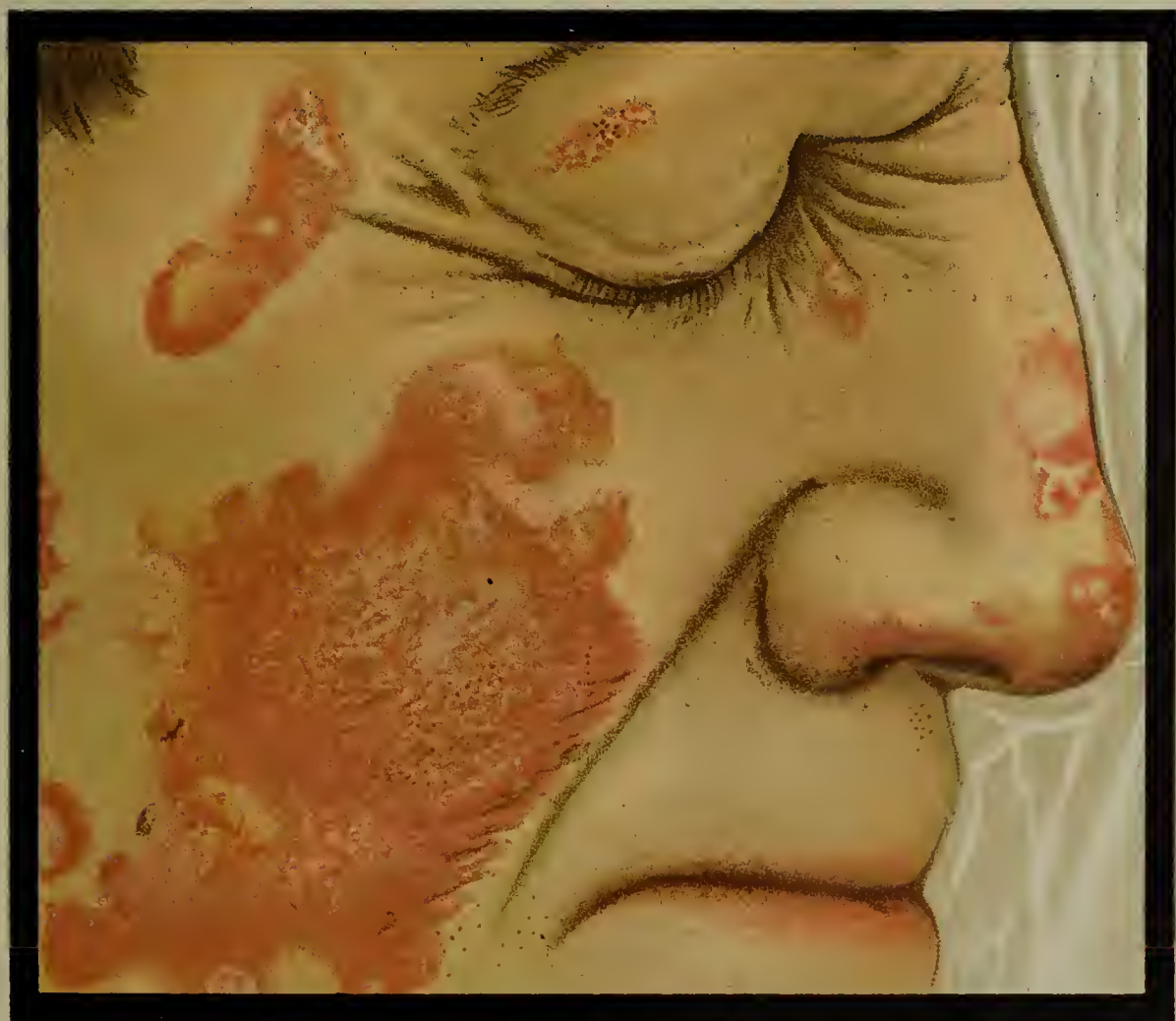
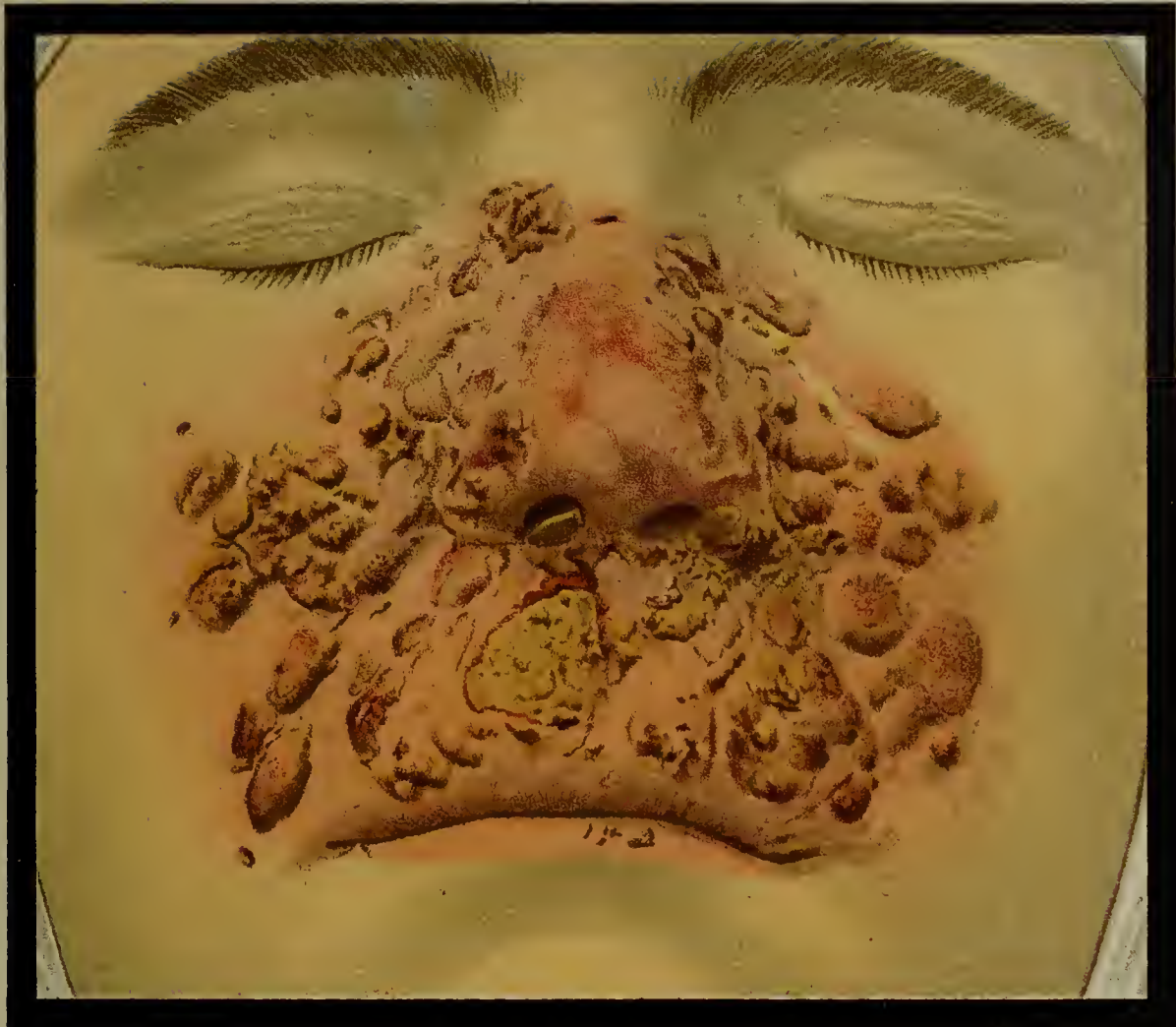


Fig.1 Lupus Vulgaris (Besnier.) Fig.2 Lupus Erythematosus (Hallopeau.)

Le Musée de l'Hôpital St. Louis, Published by Rueff & Co. 106 Boulevard St. Germain, Paris





having no destructive action upon the tissues themselves, the resulting cicatrices are few as compared to other measures. Unfortunately lupus of the mucous membranes cannot be satisfactorily reached.

Case of verrucose lupus vulgaris of the hand which had been much improved by applications of radium. The first application was made during seventy-two hours, and produced a lasting discoloration; fifteen days later ulceration followed. Two months later another application of radium was made, lasting one hundred and twenty hours; this produced a loss of substance which still persisted. Seven other applications were made of twenty-four hours' duration; these left no trace. Compared with the condition presented during former visits to the hospital, the improvement was very considerable. The verrucous elevations had disappeared, leaving a smooth cicatrix of healthy aspect. Hallopeau and Gadaud (*Annals de Derm. et de Syph.*, No. 71, 1902).

According to J. Rudis-Jicinsky (*Amer. X-ray Jour.*, Oct., '98), the Roentgen rays constitute the best means for producing artificial inflammation, and converting unhealthy ulcerations into open healthy granulations, followed by cure.

### Lupus Erythematosus.

This form of lupus is not believed to be tuberculous, as a rule, but the tubercle bacillus has been found in some cases and the disease can therefore be considered in this section.

The earliest appearance of lupus erythematosus, as described by L. A. Bidwell, is a patch of redness around the opening of a sebaceous gland. This gradually spreads in size, and the surface becomes scaly, the margin is defined, and slightly raised; the spots coalesce, and new ones form which, in their turn, join the older ones. When of any size the patch becomes covered at its centre by thick shagreen-like scabs, which, when forcibly detached, bear on their under

surface dried columns of epidermic cells which have been pulled out of the dilated openings of the sebaceous glands. The disease often becomes stationary after spreading to a considerable extent; the margins then lose their bright hue, and a depressed punctate scar remains. When hairy parts have been affected, permanent baldness results from destruction of the hair-follicles. (*See colored plate.*)

This form of lupus is seen on the face more often than elsewhere, and tends to be symmetrical. Starting on the nose or one cheek, it spreads in both directions, and in severe cases resembles a butterfly, the wings on the cheeks and the body on the nose. Other patches appear on the lobules of the ears, and occasionally on the forehead; they also are seen on the backs of the hands, but seldom on the feet.

Lupus erythematosus attacks people with feeble circulation such as are liable to chilblains, etc., and it chooses for its starting-point a part where the blood-supply is poor and where there is little subcutaneous fat: *e.g.*, the nose, or ear. The eruption can sometimes be traced to exposure, to great heat, or to cold. It is more common in females than in males.

**Diagnosis.** — Hallopeau (*Annales de Derm. et de Syph.*, Nos. 8 and 9, '96) states that the tuberculous nature of any cutaneous affection may be affirmed from the presence of any one of the four following characteristics: (1) the possibility of transmitting tuberculosis by the serial inoculation of morbid products; (2) the presence of the characteristic bacilli in the affected tissue; (3) intra-inoculation — *i.e.*, the production of a dermatosis by the proliferation of alterations clearly tuberculous, and, reciprocally, the production of tuberculosis consecutively to the development of this dermatosis; (4)

the appearance of differential eruptions, such as lichen scrofulosorum, under the influence of inoculations of tuberculin. The forms of cutaneous tuberculosis due to bacilli are the sclerotic lupus, or tuberculosis verrucosa (Riehl and Paltauf); anatomical tubercle; tuberculous gumma; tuberculous tumor; tuberculous ulcer; suppurative tuberculous.

**Treatment.**—Many cases of lupus erythematosus can be cured, according to Unna (Jour. Cut. and Genito-Urin. Dis., Oct., '98) by the sole use of external applications. Among the external remedies which he has seen to do most good is the following prescription:—

℞ Zinci ox.,  
Boli rubræ, of each, 30 grains.  
Boli albæ,  
Magn. carbon., of each, 45 grains.  
Amyli, 2 1/2 drachms.—M.

Another one which, long continued, he has found to be followed by a cure in a number of cases, without the help of any other remedy, is a combination of soap collodion, as in the following formula:—

℞ Collodion, 5 drachms.  
Sap. virid., 1/2 to 1 drachm.—M.

The same clinician frequently employs medicated collodion painted over the affected area from two to four times a day. The collodion used for the preparation must have a neutral, not an acid, reaction.

℞ Saponis viridis, 2 to 4 parts.  
Collodii flex., 20 parts.—M.  
℞ Saponis viridis,  
Ac. salicylici, of each, 2 parts.  
Collodii flex., 20 parts.—M.

To be used if the skin shows much irritation:—

℞ Ichthyol, 5 parts.  
Collodii flex., 20 parts.—M.

In two patients with erythematous lupus who have been treated with alcohol there is a distinct retrogression of the disease. Where the disease was slight, as upon the ear and the cheek, it has completely disappeared; at the inner canthus, which is less accessible to treatment, the retrogression is less marked. Hebra (Archiv f. Derm. u. Syph., B. 48, H. 1, '99).

Case of lupus erythematosus in which lotions of sulphate of zinc, sulphide of potassium, and sulphur were used without improvement. Iodoform was then given in the form of pills containing 1 grain, after meals, the lotion being continued.

At first the eruption got worse, but by the end of the third week the itching and the inflammation began to subside, and in three months the disease had completely disappeared. Whitehouse (N. Y. Med. Jour., Feb., '99).

Case of lupus erythematosus cured by x-rays. The lesion, of five years' duration, was cured after five exposures of ten minutes. The patient was a woman of 32, and there was no history of tubercle. The growth was on the cheek, and the size of half a dollar. The follicular orifices were enlarged, and filled with hardened, sebaceous matter. The rest of the face was protected with a sheet of lead. A current of eleven volts was used. The distance from the tube was seven inches. After the second exposure the erythema was fading, and the raised margins level with the skin. After five exposures the patch was covered with a healthy cicatrix. Woods (Amer. Jour. Med. Sciences, Dec., 1901).

Case of epithelioma complicating lupus erythematosus. Under nitrous oxide the growth was scraped, and when bleeding had ceased the x-rays were applied. The rest of the face was covered with a lead mask. Ten-minute exposures were given daily for about five weeks, when the healing process stopped and the new epithelium disappeared. After this shorter exposures of five minutes were given. The nose was quite healed in about three months from the beginning of treatment. Salicylic ointment was also used (10 grains to 1 ounce). Microscopical exam-



ination confirmed the diagnosis of epithelioma. Stopford Taylor (Brit. Med. Jour., May 3, 1902).

Case of lupus erythematosus showing excellent results from the use of Finsen light. In all, fourteen applications were given, the sittings having taken place every third day. Of 4 cases under observation, 3 are doing well. Gottheil (Phila. Med. Jour., Dec. 6, 1902).

**TUMORS.**—The word “tumor” literally means a swelling, but in this article it is employed in its more restricted sense: a neoplasm or new growth. As so used, it may be defined as a non-inflammatory mass of autonomous tissue, having an atypical structure and indefinite growth, and being useless for any known purposes of the human economy.

The term “tumor” does not then include the infective granulomata, which are due to specific organisms, parasitic cysts, inflammatory aggregations of cells, and hypertrophied tissues. Pure retention cysts do not properly belong here either, unless they are associated with proliferation of their framework. If it should be definitely shown that any variety of cancer were due to a specific agent, it should then be no longer classified among the tumors.

In speaking of tumors certain terms are used which should be clearly understood. Neoplasms are said to be *heterotopic* when they are formed of tissues different from those in which they occur; *heterochronic* when the tissue composing the tumor occurs at a period of life when such tissue should not exist in the body; and *autonomous* when tumors are governed by their own laws, without reference to other parts of the body, and thus possess independent functions.

*Telangiectasis* refers to a condition in which the terminal portions of arteries,

the capillaries, or the commencing parts of the veins are dilated and overfilled with blood, the process not being attended with the usual signs of inflammation. The term *scirrhous*, which means, literally, hard, is applied to an indurated tumor, the term being especially used in connection with cancers. In these cases the connective-tissue elements predominate over the cellular constituents. The opposite term is *encephaloid*, medullary, or soft.

If a tumor is made up of two kinds of tissues, the variety which predominates in quantity or importance is named last. Thus, a tumor of the uterus composed one-third of unstriated muscular tissue and two-thirds of fibrous tissue would be called a myofibroma. A tumor which contains any elements of sarcomatous tissue, however, should have the word sarcoma as the terminus of its name.

By *metastasis* is meant the removal of characteristic portions of the tumor to some other part of the body and their independent growth in that situation, the daughter-growth possessing more or less the characteristics of the primary lesion. *Infiltration* is the diffusion of the constituents of a tumor into the surrounding tissues or cavities.

Tumors are called *malignant* if they possess the properties of recurrence, metastasis, or infiltration and destruction of the neighboring tissues; *benign*, or innocent, if they grow slowly, permitting the adjacent organs to adapt themselves more or less completely to the presence of the foreign body, and lacking the properties just enumerated as belonging to malignancy. The situation of a new growth may determine whether it is malignant or not. Thus, a tumor infiltrating the brain might so derange cerebral functions as to render it malignant, while if situated in the foot it

might remain a localized affection, only interfering with locomotion.

**General Considerations.**—Tumors occur in all tissues, at all ages, and in all parts of the body, and are formed of cells which are more or less like those of normal tissue occurring during either intra-uterine or extra-uterine life. They receive their blood-supply by connections

Different kinds of tumors may be found in the same organ. It is even possible for a cancer and a sarcoma to exist as independent growths in the same person. Thus, Coley (*Annals of Surgery*, Apr., '98) describes a case of cancer of the breast co-existing with sarcoma of the submaxillary region. Williams has collected 11 such cases, and there are more

TABLE OF MACROSCOPICAL DIFFERENCES BETWEEN BENIGN AND MALIGNANT TUMORS.

<i>Benign Tumors.</i>	<i>Malignant Tumors.</i>
1. Are homologous and typical.	1. Are heterologous and atypical.
2. Are rich in fibres and poor in cells.	2. Are poor in fibres and rich in cells.
3. Grow centrally and comparatively slowly.	3. Grow peripherally and comparatively fast.
4. Have a capsule.	4. Are not capsulated.
5. Are usually poor in blood-vessels, except angioma.	5. Are rich in blood-vessels, except hard cancer.
6. Are usually fair in consistence and dry, except myxoma.	6. Are soft and juicy.
7. Seldom ulcerate, except lipoma.	7. Often ulcerate in tumor itself.
8. May grow large and grow upward.	8. Seldom grow large, except sarcoma springing from bone. Grow principally downward.
9. May be primarily multiple.	9. Not primarily multiple, except melanotic sarcoma.
10. Do not recur after removal.	10. Do recur after removal.
11. Give no metastasis.	11. May give metastasis.
12. No cachexia.	12. Cancer gives a cachexia, especially when the metastasis has taken place.
13. May kill mechanically by weight, pressure, hæmorrhage, etc.	13. Kill by infiltration and destruction of the surrounding tissues.
14. Prone to calcareous infiltration and fatty degeneration.	14. Prone to colloid and telangiectatic changes.

with previously existing channels, which develop from sprouts formed by the proliferating cells of the old blood-vessels. A round-celled infiltration is common. Division of cells takes place mostly by karyomitosis, which may be irregular in character. Tumors can usually be differentiated by the naked eye from the surrounding tissues, but the infiltration is sometimes revealed only by microscopical study.

Tumors may vary in weight up to 165 pounds or more. Their growth may be rapid or slow, covering a period of many years, with remissions and exacerbations.

of them to be found scattered throughout medical literature. Lannois and Courmont (*Rev. de Méd.*, '94) give an interesting account of two primary cancers occurring in the digestive tract of the same individual. Tumors, no doubt, have an internal secretion, though this secretion is of no use to the system. In rare cases a neoplasm may secrete one of the normal juices of the body; for example, a tumor of the liver may produce a multiplication of the bile-ducts and biliary tubes which are capable of functioning, or an ovarian tumor may form colloid material. Beyen reported, in



December, 1899, to one of the sections of the College of Physicians of Philadelphia, a case of ovarian cyst associated with undoubted diabetes, in which removal of the tumor caused a disappearance of the glycosuria and other diabetic symptoms.

The shape of a tumor is influenced by its character, method of growth, situation, mechanical pressure, etc. Tumors may appear as uniform swellings, flat tabular swellings, tubers, nodes, or as fungoid, polypoid, papillomatous, dendritic, mushroom-like, sessile, pedunculated, cauliflower-like masses.

When tumors are deep-seated, we have:—

1. Uniform swelling: (*a*) glioma; (*b*) lymphoma; (*c*) lymphangioma; (*d*) sarcoma; (*e*) rhabdomyoma; (*f*) lymphosarcoma.

2. Nodes growing centrally: (*a*) fibroma; (*b*) myoma; (*c*) myofibroma; (*d*) myxoma; (*e*) adenoma; (*f*) osteoma; (*g*) chondroma; (*h*) secondary cancer and sarcoma.

3. Nodes growing peripherally: (*a*) primary sarcoma; (*b*) primary carcinoma.

4. Cysts: (*a*) retention; (*b*) extravasation; (*c*) exudation [as ovarian and parovarian]; (*d*) softening; (*e*) parasitic; (*f*) dermoid.

When on the surface they appear as:—

1. Flat tabular swelling: (*a*) keloid; (*b*) angioma; (*c*) lymphangioma; (*d*) squamous epithelioma; (*e*) cholesteatoma; (*f*) sarcoma of serous membranes.

2. Tubers (a partly projecting node): (*a*) osteoma; (*b*) chondroma; (*c*) osteochondroma; (*d*) giant-cell sarcoma.

3. Fungi (fungus hæmatoides): (*a*) soft cancer; (*b*) telangiectatic sarcoma; (*c*) cavernous angioma.

4. Polyps: (*a*) myxoma; (*b*) soft fibroma; (*c*) lipoma; (*d*) adenoma; (*e*) sarcoma of serous sacs.

5. Dendritic: (*a*) warts; (*b*) papilloma; (*c*) epithelioma.

6. Papillæ: (*a*) horns; (*b*) corns; (*c*) condyloma.

It is at times impossible from microscopical study alone to tell a sarcoma from granulating tissue. In one well-known case the ulcerating area of a lipoma was diagnosed as malignant, the leg was amputated, and death resulted. We cannot always distinguish sarcoma, such as an endothelioma, from a cancer, an adenocarcinoma from an adenoma, or an adenoma from an hyperplastic glandular structure.

**Etiology.**—1. A first group of tumors may be regarded as being composed of congenital deposits of tissue in an abnormal situation or of rests of tissue which do not disappear in the course of development (Cohnheim's theory). These patches are usually present at birth and develop in later life. To this group belong many varieties of osteoma, chondroma, angioma, lipoma, fibroma, sarcoma, adenoma, cysts, and teratoid tumors. The latter may originate in a transposition of tissue-cells, in the implantation of a rudimentary portion of a twin, or in the pathological growth of male or female cells of generation.

Osteoma is, for the most part, to be explained on embryonal grounds (Cohnheim). It is often seen as an exostosis in the neighborhood of an epiphysis or as an ossification of some cartilaginous "rest"; in many other cases it is the result of traumatic osteoperiostitis, or of syphilis or rachitis.

Chondroma is most common in infancy and childhood, and its consideration is practically inseparable from that of rickets. Such cartilaginous tumors as are not to be explained as expressions of rachitis are to be regarded as inclusions, according to the embryonal theory of Cohnheim. Roswell Park (Amer. Jour. Med. Sci., May, '98).

2. From 14 to 17 per cent. of all tumors arise after an injury, though, no doubt, some of these cases owe their development to the irritation by the traumatism of embryonal rests pre-existing in the body. Out of one hundred and seventy cases of sarcoma collected by Coley (*Annals of Surg.*, Sept., '97), 27 per cent. gave a history of trauma; in one case the tumor appeared within a week after the injury. Such a case raises an interesting question as to the liability of an accident insurance company. While Coroner's Physician of Philadelphia a body came to me for autopsy in which there was doubt as to whether a kick might have given rise to a cancer of the large intestine (Virchow's theory).

Analysis of 714 cases, embracing benign and malign growths. But 19 could with more or less certainty be traced to an antecedent trauma. If the "probable" cases were added the proportion could be placed at 5 per cent.

Most benign growths originated without any causal connection with trauma. In osteomas, however, no less than 40 per cent. were traceable to a severe injury; yet even under these circumstances the underlying cause may have been an osteomyelitis, tubercular or syphilitic, or even an attenuated bacillary infection. Sarcoma due to trauma is represented by 7 per cent., while carcinoma figures with but 1 per cent., the injuries having never been of a severe nature. Statistically, traumatism is an etiological factor only in osteomas, carcinomas, and sarcomas. K. Wurz (*Beitrag zur klin. Chir.*, B. 26, H. 3, 1900).

3. Tumors follow inflammations, especially ulcers which have resulted in extensive cicatrization. Thus, an epithelioma may develop from lupus; a keloid, especially in the colored race, from a scar; or a cancer at the border of a gastric ulcer. Cancer may also occur in the floor of a tuberculous or syphilitic granulating area, and an adenocarcinoma in

the large intestine from a healing or healed typhoid ulceration.

Study of the relation of traumatism to malignant growths based on 328 cases of carcinoma and 171 of sarcoma observed in the surgical clinic in Munich during the last five years. Of the 328 cases of carcinoma, 117 were in men and 211 in women; and of 171 cases of sarcoma, 81 were in men and 90 in women. After deducting tumors of the mamma and genital organs there were 108 tumors in men and 102 in women. In the carcinomata there was a history of a single trauma 92 times. In the sarcomata a single trauma was noted 35 times, and 32 times there was a history of chronic irritation (including warts). Some cases of single trauma seem to stand in doubtful relation to the formation of the tumor, but, as a rule, the new formation has been occasioned by injury. Ziegler (*Münch. med. Woch.*, Nos. 27, 28, '95).

One hundred and seventy cases of sarcoma personally examined with a view to determine the frequency of trauma as an exciting cause. Out of these, 46, or 27 per cent., followed injury; 18 of these were osteosarcoma and 26 affected the soft parts. The sarcomas were round-celled in 29 cases, spindle-celled in 5, melanotic in 5, cylindroma in 1, chondrosarcoma in 2, mixed in 3, and doubtful in 2 cases.

The intervals of time between the injury and the development of the sarcoma were: Within a week in 8 cases; from 1 to 4 weeks in 10 cases; from 4 to 8 weeks in 6 cases; from 2 to 6 months in 7 cases; from 6 to 12 months in 4 cases; *i.e.*, 24 out of the 46 cases developed within 2 months after the injury.

The nature of the injuries included blows, falls, contusions, fractures, sprains, lacerations, burns, shot wound, and abrasions.

Assuming that sarcoma is due to an infectious micro-organism (which is not unlikely), the explanation of sarcoma following injury is easy. W. B. Coley (*Annals of Surg.*, May, '98).

Fibromata are usually of traumatic origin, and, if careful investigation be made, the majority will be found to contain minute foreign bodies, such as



slivers, splinters, etc., which have served as the exciting cause. This is especially true of those fibrous tumors found about the hands and feet.

The lipomata find their explanation in some disturbance of nutrition due to faulty innervation. They are usually of traumatic origin. The injury has usually been so slight and so long past as to be forgotten. Lipomata are frequently multiple, and then usually symmetrically placed, and such distribution can be explained only through the agency of the nervous system. Roswell Park (*Amer. Jour. Med. Sci.*, May, '98).

The various so-called parasites fail to make good in fulfilling the requirements of an infecting agent. The vast majority of competent pathologists are of the belief that the so-called parasites are changed or degenerated cells, not yet thoroughly classified.

Contaminations could not be excluded in the few cases that showed any growth out of the vast number of cultures taken on every known media.

The tumors produced by inoculation of blastomycetes show them to be only granulomata. Blastomycetes can be cultivated from the air. Hence, contamination is always possible. In short, it is true that no one has to the present been able to grow or demonstrate parasites in malignant growths.

The facts and arguments are so overwhelmingly on the side of the embryonic cell theory that for the time being at least it shall have to be believed that malignancy is due to an abnormal play of forces within the body, of which as yet little is known.

A benign tumor is an abnormal deposit or growth of normal tissue, at least for a time; a supernumerary toe is normal tissue growing in an abnormal position. Why is not a malignant tumor an abnormal growth of abnormal tissue? A logical conclusion would be that it is.

Time will show a reaction in the present movement of parasitism and many of its strongest advocates will refute their theories and admit that their conclusions were reached without sufficient investigation. C. H. Richard-

son (*New York Medical Journal* and *Philadelphia Medical Journal*, Aug. 27, 1904).

4. The fourth group consists in the overgrowth of some constituent of the body while the contiguous tissue is undergoing senile atrophy. For example, some epitheliomata which occur in old age are due to the fact that the epithelial cells have not lost their power of proliferation, while the connective tissue is undergoing atrophy and seems to be no longer able to protect the tissues underneath from the ingrowth of the epithelial cells.

5. Ribbert believes that a separation of cells or a group of cells from the organic (nervous) control of the tissues in which they are normally found is the determining factor in the production of a tumor. This loss of control may take place either by disturbances in intra-uterine development, or, later on, by the influence of external agents. And yet this very thing frequently occurs and no tumor develops, but rather atrophy of the tissue. A portion of thyroid gland introduced into the breast of a patient suffering from myxoma gives rise to a certain amount of curative action, but the piece of gland inoculated quickly atrophies and entirely disappears.

When the complexity of the human body is considered, it seems surprising that outgrowths of tissues in the form of tumors are of so infrequent occurrence. Is there somewhere in the nervous centres a working model of the body, which by an unknown force is so controlled that there is departure from the normal shape without an assignable cause?

6. There can be but little doubt that some varieties of tumors, such as papilloma and cancers, are due to infecting agents received into the body from without. At the present time no such organism has, however, been demonstrated.

Irritation alone cannot be the cause of cancerous tumors, or else they would occur more frequently. Parasites frequently cause cell proliferation independent of inflammatory conditions, as shown by the lymphomata of typhoid and the enlarged spleen of malaria, a proliferation analogous in general features to cancer; they produce metastases as does cancer; they often select special cells for their habitat, as blood-cells in malaria, multinuclear leprosy cells in leprosy, and giant cells in tuberculosis, while the hypothetical cancer parasite may equally well choose epithelium. Finally, certain parasites, coccidia, cause in the bile-ducts of rabbits an increase of epithelial and fibrous tissue closely resembling malignant adenoma of the rectum. C. F. Martin (Montreal Med. Jour., Feb., '96).

In reviewing the present state of knowledge as to the etiology of cancer the following propositions are advanced: That in malignant growths of men and animals certain extraneous bodies may be found within the protoplasm of the cell. These bodies are identical morphologically with the so-called coccidia found by various authors in the cells of epitheliomata and sarcomata. They are blastomycetes, and resist acids and alkalies just as these parasites do. They are found in malignant growths only and in no other pathological growth. They are generally seen at the growing edge of a new growth, not in the centre, and only exceptionally in the cell-nuclei. They react to special methods of staining, and may be obtained in pure cultures from the malignant neoplasms of men and animals. The lower mammalia (guinea-pigs, rabbits) are more susceptible to inoculation with these blastomycetes than the higher (dogs). Thus, while certain blastomycetes in the lower classes give rise to generalized lesions, in the higher mammalia the lesions are localized. These lesions have essentially neo-productive and non-inflammatory characters. The question of the etiology of cancer can be resolved only when the blastomycetes isolated from malignant tumors of animals of one species reproduce in animals of the same species the

same malignant growths. Roncali (Suppl. Policlin., Oct. 31, '96).

All the so-called parasites which have, up to the present, been described as occurring in cancers are susceptible of explanation as degenerations of one or all of the constituents of tumor-cells or as metamorphosis of their secretion. H. J. Stiles (Lancet, Feb. 27, '97).

The following deductions may be made from personal observations and experiments:—

1. That in cancers there are certain intracellular bodies (which may also be found rarely outside the cells) which are neither parts of the cell structure nor any known degenerative change, and which are only found in cancer; and that they are only found at the periphery of the growing parts of a cancer, and not in the degenerated parts, and that these bodies have distinctive microchemical reactions.

2. That there are certain cancers, which occur rarely, in which these bodies are present in enormous numbers.

3. That by the use of appropriate means these bodies can be isolated and cultivated outside the body.

4. That these cultures, when introduced into certain animals, can cause death, with the production of tumors, so far of endothelial origin; and that pure cultures can be made from these tumors which, if inoculated into suitable animals, will produce again similar growths. H. G. Plimmer (Practitioner, Apr., '99).

Tumors may be considered as being derived:—

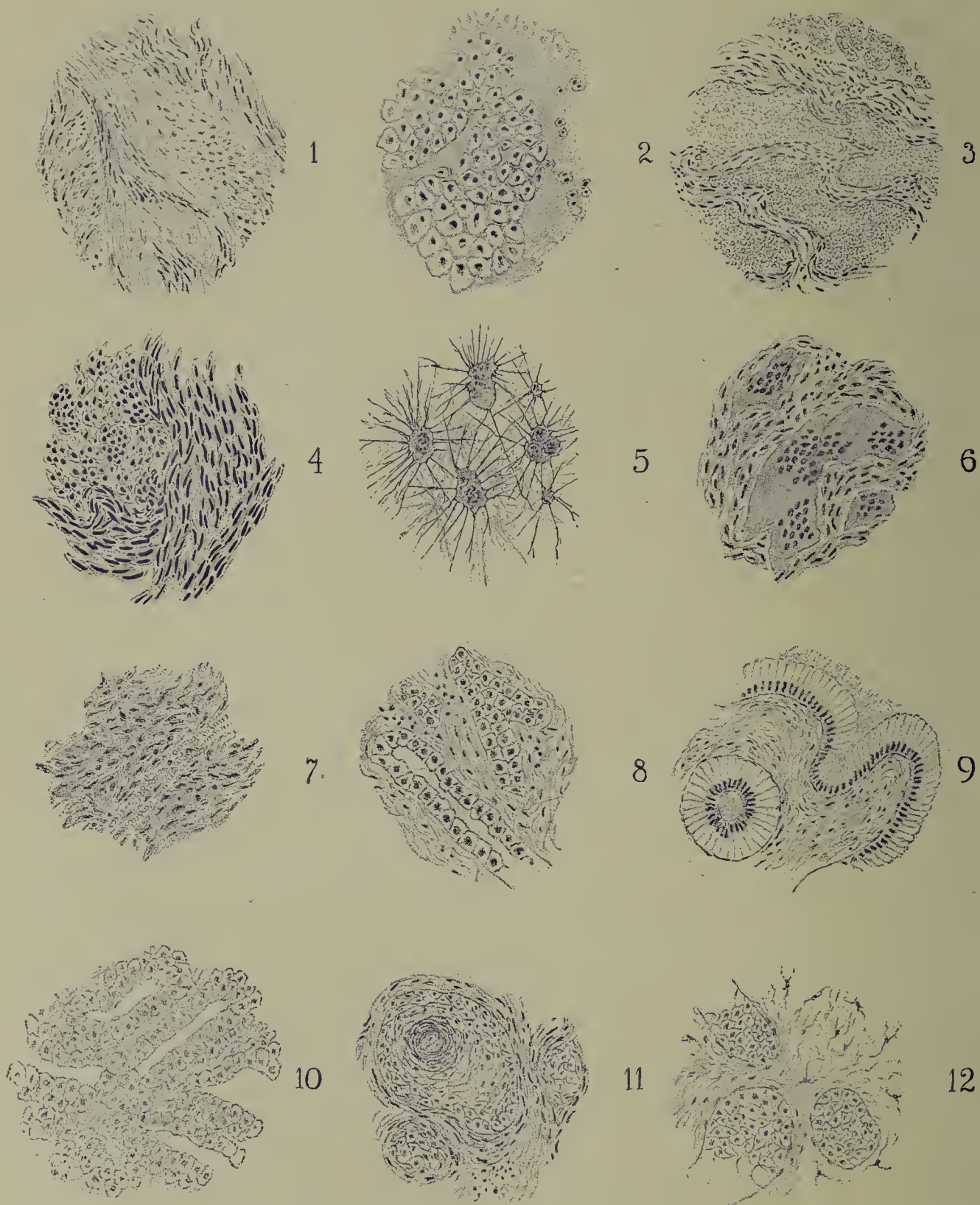
1. From embryonic cell "rests," which have for a shorter or longer period remained latent in one or other tissue and then have taken upon themselves a rapid proliferation, leading to tumor-formation.

2. From the mother-cells of a tissue which, remaining undifferentiated, but capable of active proliferations throughout life, now assume excessive proliferative powers, their daughter-cells retaining to a greater or less extent the characters and the properties of the mother-cells.

3. From differentiated cells which, reverting to a simpler, more embryonic type, with this reversion gain the capac-







1, Fibroma. 2, Chondroma (after Ziegler). 3, Cavernous angioma of the liver. 4, Myoma. 5, Glioma of the brain. 6, Giant-celled sarcoma. 7, Spindle-celled sarcoma. 8, Endothelioma of the pia mater. 9, Adenoma. 10, Cancer. 11, Epithelioma with an epithelial pearl. 12, Myxomatous cancer.



ity for active and excessive proliferation. J. G. Adami (Jacobi Festschrift; Phila. Med. Jour., May 26, 1900).

We can only say that, for the development of a tumor, inherited and acquired characteristics of certain cells and groups of cells show a tendency to increased activity, with the formation of atypical tissue.

**Classification of Tumors.**—Tumors should be investigated in the same manner as the botanist studies plants: by groups, genera, species, and varieties. This method of procedure has been best elaborated by J. Bland Sutton, in his work on tumors, innocent and malignant, and the arrangement herein fol-

lowed is based largely upon his classification as there given.

According to Sutton, tumors are conveniently arranged into four main groups, each group containing several genera, each genus having one or more species, each species being divisible, in turn, into one or more varieties. The groups and genera are based on their microscopical and embryonal appearances, while the species usually represent their situation in the body or some striking characteristic.

The groups are: I. Connective-tissue tumors. II. Epithelial tumors. III. Dermoids. IV. Cysts. Subgroup: pseudocysts.

#### I. CONNECTIVE-TISSUE TUMORS.

##### *Genera.*

1. Lipomata (fatty tumors). (The word lipoma is not to be confused with lipæmia, the latter word meaning fat in the blood.)
2. Chondromata (cartilaginous tumors).
3. Osteomata (osseous tumors).
4. Odontomata (tooth-tumors).
5. Fibromata (fibrous tumors).
6. Myxomata.
7. Gliomata (neuroglial tumors).
8. Sarcomata. These tumors are made up of embryonal connective tissue.

##### *Species.*

1. Subcutaneous. 2. Subserous. 3. Subsynovial. 4. Submucous. 5. Intermuscular. 6. Intramuscular. 7. Periosteal. 8. Meningeal.
1. Chondromata. 2. Ecchondroses. 3. Loose cartilages in joints.
1. Osteophytes. 2. Enostoses. 3. Exostoses. 4. Periosteal exostoses. 5. Parosteal osteoma. 6. Disconnected osteoma. 7. Heteroplastic osteoma.
1. Epithelial odontome, from the enamel organ. 2. Follicular odontome. 3. Fibrous odontome. 4. Cementome. 5. Compound follicular odontome. (2, 3, 4, and 5 are from the tooth-follicle.) 6. Radicular odontome; from the papilla. 7. Composite odontome; from the whole germ.
1. Simple fibromata. 2. Molluscum fibrosum (include here keloid). 3. Neurofibromata.
1. Nasal and aural polypi. 2. Cutaneous myxomata. 3. Neuromyxomata.

Found in brain, cord, and retina.

1. Round-celled sarcoma (small and large). 2. Lymphosarcoma. 3. Spindle-celled sarcoma (small and large). 4. Alveolar. 5. Melanotic.

The relative malignancy of the sarcomata is as follows: 1st. Lymphosarcoma; small, round-celled sarcomata; melanotic, spindle-celled myosarcoma; spindle-celled chondrosarcoma; myeloid sarcoma.

*Genera.**Species.*

9. Myelomata, usually known as myeloid, or giant-celled, sarcoma. Red marrow as a tissue is as distinct as adipose, myxomatous, or fibrous tissue, and is entitled to be placed in a separate genus by itself. (Edinburgh Med. Jour., Feb., '97).
10. Psammoma endothelioma. Ziegler considers it probably advisable to class this among the epithelial tumors notwithstanding the fact that the cells of the pericardium, pleura, blood-vessels, etc., arise from the mesoderm.
11. Myomata (muscle-tumors).
12. Neuromata (tumors on nerves).
13. Angiomata (tumors composed of blood-vessels).
14. Lymphangiomata (tumors of lymphatic vessels).

1. Leiomyomata (rhabdomyomata, considered by Sutton as a variety of the spindle-celled sarcoma). Met with in the uterus, broad ligament, ovary, ovarian ligament, round ligament of the uterus, vagina, œsophagus, stomach, intestine, scrotum, skin, bladder, and prostate.

1. Neurofibromata. 2. Plexiform neuromata. 3. Traumatic neuroma.

1. Simple nævus. 2. Cavernous nævus. 3. Plexiform angioma.

1. Lymphatic nævus. 2. Cavernous lymphangioma. 3. Lymphatic cyst.

## II. EPITHELIAL TUMORS.

*Genera.**Species.*

1. Papillomata.
2. Cutaneous horns.
3. Epithelioma.
4. Adenoma.
5. Carcinoma (cancer).

1. Skin warts. 2. Villous papillomata. 3. Intracystic warts. 4. Psammomata.

1. Sebaceous horns. 2. Wart horns. 3. Cicatricial horns. 4. Nail horns.

## Epithelioma.

1. Mammary. 2. Sebaceous. 3. Thyroid. 4. Pituitary. 5. Prostatic. 6. Parotid. 7. Hepatic. 8. Renal. 9. Ovarian. 10. Testicular. 11. Gastric. 12. Intestinal. 13. Fallopian. 14. Uterine.

1. Mammary. 2. Sebaceous. 3. Thyroid. 4. Prostatic. 5. Parotid. 6. Pancreatic. 7. Hepatic. 8. Renal. 9. Ovarian. 10. Testicular. 11. Gastric. 12. Intestinal. 13. Fallopian. 14. Uterine.

## III. DERMIDS.

*Genera.*

1. Sequestration dermoids.
2. Tubulo-dermoids.
3. Ovarian dermoids.
4. Dermoid patches.

## IV. CYSTS.

*Genera.**Species.*

1. Retention cysts

1. Hydrometra. 2. Hydrosalpinx. 3. Hydro-nephrosis. 4. Hydrocholecyst.



*Genera.*

2. Tubulo-cysts.

3. Hydroceles.

4. Gland-cysts.

*Species.*

1. Vitello-intestinal. 2. Allantoic (urachal).  
3. Paroöphoritic. 4. Parovarian. 5.  
Cysts of Gärtner's duct. 6. Cystic dis-  
ease of testis. 7. Encysted hydrocele of  
testis. 8. Cysts of Müller's duct.

1. Of the tunica vaginalis. 2. Of the canal  
of Nück. 3. Of the ovary. 4. Of the  
neck.

1. Ranulæ. 2. Pancreatic cysts. 3. Chyle-  
cysts. 4. Dacryops.

There are conditions often classed as cysts which are arranged in a subgroup entitled  
PSEUDO-CYSTS:—

1. Diverticula.

2. Bursæ.

3. Neural cysts.

4. Parasites.

1. Intestinal. 2. Vesical. 3. Pharyngeal. 4.  
Esophageal. 5. Tracheal. 6. Synovial.  
7. Meningeal.

Bursa.

1. Hydrocephalus. 2. Hydrocele of fourth  
ventricle. 3. Meningocele (cranial). 4.  
Spina bifida.

Hydatids.

**I. Connective-Tissue Tumors.**

**Lipomata.**—Lipomata most frequently grow in those situations where fat is normally present, exceptions being found, as in the brain and the submucous tissue of the intestine. They may be single or multiple, and frequently reach a large size, weighing at times as much as 100 pounds. Even in marked emaciation a fatty tumor does not show the atrophy which one would naturally expect. An hereditary tendency is sometimes noticed. Ulcération often takes place at a point opposite the entrance of the blood-vessels, and pyogenic micro-organisms may gain access to the body by this means. There is often a history of a blow or of irritation to account for the development of these tumors.

Macroscopically, lipomata are composed of adipose tissue, and appear as rounded, lobulated, capsulated masses. They may be pedunculated. Septa containing the blood-vessels run from the capsule, dividing the tumor into lobules. They frequently undergo myxomatous degeneration, and show calcareous infiltration. Unless irritation has occurred,

lipomata are movable within their capsule. Care must be taken not to mistake this class of tumors for cysts, especially if they are situated upon the head. The sucking cushions of the cheek in emaciated children sometimes stand out prominently and may be mistaken for lipomata. Madelung ("Ueber den Fett-hals," Langenbeck's Arch., vol. xxxvii, '88) has observed in males a rare nodular and infiltrating lipomatous condition in the neck (fatty neck).

On the palm of the hand, where they are usually congenital, they may simulate a ganglion. Lipoma of the palm or in other situations may be distinguished from a fluid collection by spraying ether over the part. In case of lipoma the fatty matter will become solidified by the cooling process. In a recent post-mortem the writer found that the surgeon had mistaken some small lipomatous masses in the inguinal canal for the omentum, and had reduced the sac of the hernia, believing it to be bowel. Persons have worn trusses for years, thinking that they had hernia, where the masses were only fat. The appendices epi-

plœicæ when markedly enlarged may be considered to be lipomata. Microscopically the tissue looks like ordinary fatty tissue, but the full-formed cells are rather larger, and numerous smaller connective-tissue cells are found, containing, as yet, little or no fat. The cells are frequently polyhedral from pressure.

**Chondromata.**—Chondromata, or enchondromata, are tumors which are chiefly made up of cartilaginous tissue. Connective tissue usually covers their surface (perichondrium) and forms penetrating bands in which the blood-vessels are to be found. They usually develop in those situations where cartilage is normally to be seen, but they also occur in those situations where one normally does not expect to find cartilage, as in the testicle and the parotid. Sutton (Practitioner, Nov., '97) states that chondromata are fifty times as frequent in the parotid gland as in the submaxillary. No case has been described in the pancreas. In bones they usually originate in the periosteum and the marrow, though they often spring from remnants of cartilaginous tissue which have not been converted into bone. In one of my cases the tumor grew from the pelvis, and reached the size of a foetal head, the cartilage being almost as pure as that seen in a joint. The blood-supply, however, was poor. These tumors often appear multiple upon the hands and feet. The variety of cartilage is usually hyaline. Microscopically some of the cells are capsulated, while others are oval, polyhedral, or spindle-shaped. They are very irregularly distributed, and assume different forms in the same tumor. Chondromata which develop from previously existing cartilaginous tissue are often spoken of as ecchondroses. The cells undergo fatty degeneration, myxomatous change, calcification, and ossification. Virchow has

described, in the middle line of the clivus in the region of the spheno-occipital articulation, small tumors containing cartilage, which are either found under the dura or break their way through into the arachnoid and pia.

**Osteomata.**—Osteomata are composed of tissues more or less resembling bone in their microscopical structure. Intermediary forms are known as of the compact variety. When very dense, they are spoken of as eburnated; when loose in structure, as spongy or medullary osteomata. They are usually found in the neighborhood of bone, but may occur as heteroplastic growths: *i.e.*, in those situations, as in the lung, where no bone is normally found. Osteophytes are spiculated processes usually attached to bones, but are also found elsewhere, as in the falx cerebri, where they are quite common and are due to an internal ossifying pachymeningitis. More extensive and more tumor-like roughened prolongations from bones are spoken of as exostoses; circumscribed patches within the bone are called enostoses; periosteal exostoses, when in the periosteum, but separated from the bone; are named parosteal osteomata, when near the bone and disconnected; osteoma when still farther away.

In the eburnated variety the growths may be single or multiple, and are found especially in the flat bones of the skull. The lamellæ follow the outline of the tumor, and contain no blood-vessels or Haversian canals, though narrow canaliculi are found. The compact osteoma may be found in the meninges of the brain, in the choroid of the eye, in the pericardium, etc. The vessels and Haversian canals run at right angles to the long axis of the bone. In the spongy form Haversian systems are seen, and the character of the growth is like that seen



on the extremities of the long bones. They assume the greatest variety of forms, and combine as osteofibroma, osteochondroma, osteochondrosarcoma, and osteosarcoma. When combined with sarcomata, they may give metastasis, which sometimes even appear on the skin. The continuous exercise of a muscle, as by drilling with the gun, or in horseback-riding, may give rise to osseous formations in the muscle. Myositis ossificans is a peculiar progressive disturbance of the muscular connective tissue occurring in early youth.

**Odontomata.**—These tumors have been but little studied and are often classed among the osteomata or dermoids. They are made up of dental tissues in different amounts and in different degrees of development. Thus, there may be teeth-germs other than these normally to be developed, and these may undergo proliferative changes in any of their component parts. A tooth may grow upward into the antrum of Highmore and there develop into an odontoma. These tumors are rarely diagnosed before operation, and unnecessarily severe operations, as excising a portion of the mandible, are sometimes practiced where mere removal of the tooth or enucleation of the tumor is all that is required for their cure, as they are not malignant. Odontomata are found in early adult life. They also occur in the lower animals, as in the horse.

**Fibromata.**—Fibromata are composed of connective tissue; if rich in cells, they are spoken of as soft, and scrapings show spindle-formed cells; if made up largely of bundles of fibrils, they are called hard. They occur as nodular, capsulated tumors, sharply defined from the surrounding tissues, and are especially common in the colored race. They may assume the form of polyps or papillomata at the

junction of epithelial and mucous surfaces, as in the vagina. On section the larger nodes are white and glistening, and are seen to be made up of smaller nodes arranged concentrically; cutting gives rise to a peculiar, creaking noise. Fibrous tissue is widely distributed throughout the body; hence, as would be expected *a priori*, these tumors occur in the most diverse situations. In the breast the pericanalicular variety is often found. They are frequently multiple, especially in the uterus and the skin, and stain well with microcarmin. Areas of softening often occur, due to fatty degeneration, myxomatous changes, etc. They sometimes show dilated blood-vessels and lymph-channels, and in the uterus are peculiarly liable to undergo calcareous infiltration. In the uterus they are often combined with myoma. Elephantiasis, though attended with much overgrowth of fibrous tissue, should not be classed here, as it is due to the mechanical obstruction of the lymph-channels.

**Keloids.**—These are peculiarly dense forms of fibromata, and most often follow wounds, sometimes so small as to have escaped notice. They are sometimes very troublesome on the face, neck, and breast of colored persons. They are also seen in the spleen. Extensive thickenings of the serous membranes, such as the pleura, are the remnants of old inflammatory lesions.

**Myxomata.**—These tumors are largely composed of mucoid tissue. The cells are branched and irregular, their prolongations interweaving the one with the other. On section the surface is more or less transparent and the blood-vessels can be seen beneath the surface. Myxomatous fluid coagulates upon the addition of water. These tumors are never composed entirely of myxomatous tissue, as they must have a frame-work upon

which to be formed. The best-known varieties are fibromyxoma, lipomyxoma, chondromyxoma, and myxosarcoma. Fibrous, fatty, cartilaginous, and sarcomatous tissue may undergo myxomatous degeneration. Myxochondromata are especially common in the parotid.

**Gliomata.** — Glioma and ganglionic neuroglioma, though of epithelial origin, are classified among the connective-tissue tumors. In one of my cases at Elwyn, of a cerebral glioma, careful inspection revealed only a local swelling, flattening, increase in size of the convolutions, and slight difference in color, and the tumor was distinguished from the healthy cerebral structures with the greatest difficulty. Microscopically gliomata are composed of neuroglia, the cells giving off delicate fibres, which interlace the one with the other, the cells, which assume a large variety of shapes, having one or more nuclei. If the amount of blood contained in the dilated blood-vessels is large, they have a reddish color and softer consistency. Ganglionic neurogliomata are made up of hypertrophic neuroglia, ganglionic cells, and nerve-fibres. They form striking pictures under the microscope, and must be looked upon as due to developmental errors occurring in extra-uterine life.

**Sarcomata.** — The cells in sarcomata resemble those seen in embryonal tissue, and greatly predominate, both in number and relatively in size, over the intercellular substance. They start either in those situations where we normally have connective tissue; in tumors of connective-tissue origin, such as fibroma, chondroma, etc.; in the uterine decidua, or in dermoids. Sarcomata are rare in the liver, intestinal tract, uterus, and lungs. Degenerative changes are common. We may recognize three groups: 1. Those composed of conglomerations

of ordinary cells, not arranged in any special order or possessing any peculiar characteristics. 2. The cells are so arranged as to resemble cancerous tumors. 3. The cells, matrix, or vessels possess certain inherent characteristics which give rise to visible peculiarities. In the first group belong the small-celled and large-celled sarcomata, lymphosarcoma, small spindle-celled and large spindle-celled sarcomata, and polymorphous forms, such as the oat-seed-like variety of Hamilton. Giant-celled sarcomata are classed as a separate genus under myelomata. The second group consists of the alveolar sarcoma, the tubular sarcoma, and the endotheliomata. The latter tumors are found in the coverings of the brain, pleura, periosteum, pericardium, breast, and skin. They combine at times with angiomas. In the third group we have pigmented cells, melanosarcoma, and chloroma. In psammoma there is a deposit of sand.

Lanz (*Deut. med. Woch.*, No. 20, '99) has shown that the introduction of melanosarcomatous tissue into the spleen of a guinea-pig is attended in six weeks with the production of pigmented cells in the skin and various other organs of the animal experimented upon.

**Myelomata.** — Myelomata arise from the red marrow of cancellous bone, and are especially liable to occur in those situations and periods of life where it is present in the largest quantities. Owing to its great vascularity, its cut surface looks like fresh liver. Microscopically the giant cells predominate, though round and spindle cells may be present in considerable numbers. The tibia is the bone most frequently affected, usually in its upper position, while the radius is attacked but one-fifth as often. Of the bones of the head, the jaws alone are affected. The disease usually occurs be-



fore the 25th year, and metastasis is rare. The neoplasms sometimes weigh from 30 to 40 pounds, and, though rare, form such striking specimens that few museums are without a goodly number of them upon their shelves. Thorough enucleation or high amputation will often result in permanent cure.

**Myomata.**—Unstriped muscular fibres go to make up the tissue of a myoma, and the tumor is then called leiomyoma by those who designate tumors composed of striped muscular tissue as rhabdomyomata. These tumors are, however, better classed among the sarcomata. They are widely distributed throughout the body, and are usually combined with fibrous tissue. In the uterus they may be situated beneath the peritoneum within the uterine wall, and beneath the mucous membrane, and are called, respectively, subserous, intramural, and submucous myomata. They occur also in the adnexa and ligaments around the uterus, in the intestinal tract, scrotum, skin, bladder, and prostate. Microscopically the fascicular bands of muscular tissue are cut at all angles, and give a most varied appearance to the field, resembling here a spindle-celled sarcoma and there the cells of a fibroma. They undergo mucoid degeneration, fatty metamorphosis, telangiectatic changes, calcification, septic infection, etc. Death may ensue through hæmorrhage, mechanical effects, pregnancy, or peritonitis. To the touch they feel like a pregnant uterus. A gynæcologist once sent me a specimen which he had removed at an operation, and said he waited until he was alone before venturing to see whether or not he had made an error of diagnosis. At the menopause they usually cease growing, and for this reason oöphorectomy is often practiced with benefit.

**Neurofibroma, Plexiform Neuroma, and Amputation Neuroma.**—Neurofibroma may develop as an overgrowth of the endoneurium, the perineurium, or even the epineurium.

Multiple neuromata of the skin are known as molluscum fibrosum. Over 2000 of these small tumors may exist along the course of the different nerves involved.

Plexiform neuroma shows tortuosity and increase in size of the nerve-bundles. The classical case of Bruns in his *Beiträge z. klin. Chir.*, vol. viii, '91, occurred on the back of a youth aged 19 years.

Neuromata appear on the ends of nerves after injury, especially after amputations. They may reach the size of a cherry, and are often so painful as to demand resection or reamputation of the limb in which they occur. They are composed of connective tissue and outgrowths of the ends of the axis-cylinders.

**Angiomata and Lymphangiomata.**—Angiomata, popularly spoken of as strawberry patches, consist in a dilatation and the reproduction of new blood-vessels, the whole growing so as to give rise to a reddish and but slightly elevated tumor. Lymphangiomata show a similar dilatation of the lymphatics. They are most frequently congenital, though their growth takes place in later life. A careful examination of the face and neck will often reveal a slightly elevated reddish point, with three or four zigzag and overdilated capillaries. When in this stage they are easily destroyed. Later they undergo proliferative changes and extend in area. When once started, they may involve as much as half the face and neck and give rise to considerable disfigurement. They are composed of capillaries and veins, proliferation of the arteries not taking place.

Mibelli (*Arch. f. Dermat.*, vol. xlv,

p. 357) describes a condition which he calls angiokeratoma; it may be looked upon as a combination of a simple wart and a superficial angioma. The neoplasms are multiple, and occur almost always on the back of the hands and the feet.

Cavernous angiomas occur in the skin and the subcutaneous tissue, but more frequently in the liver, where the tissue resembles that of the cavernous body of the urethra. Hæmorrhoids are sometimes classed among the angiomas, but they are mechanical in their formation, due to interference with the circulation, and can hardly be considered as tumors proper, though bunches are sometimes seen as large as a fist.

There is a peculiar form of racemose arterial angioma in which the arteries of a certain branch become dilated. To the finger these vessels feel like a mass of worms. When lymphangioma affects the tongue, the condition is known as macroglossia; when the cheek is diseased, it is called macrocheilia.

Many varieties of nævi, sun-spots, freckles, and moles often have as their basis a lymphangiomatous condition. Unna, Kromayer, Delbanco, and Scheuber (*Arch. f. Dermat.*, vol. xlv, p. 175) are of the opinion that the cell-nests in the cellular nævi come from the epithelial layers, while Ziegler and others consider that they originate in the connective tissue. One reason for this belief is the fact that they undergo sarcomatous and not cancerous changes.

## II. Epithelial (Organoid) Tumors.

**Papilloma.**—The ordinary wart as it appears on the hand is a papillomatous growth composed of dense connective tissue containing blood-vessels and covered with epithelial cells. Lanz (*Deut. med. Woch.*, No. 20, '99) has experimentally proved the possibility of the trans-

plantation of warts. They may be as large as the fist. Warts are found on mucous membranes, and when in the bladder they are spoken of as villous tumors. Small pieces of these tumors are sometimes passed in the urine. Hæmorrhage may be excessive. Intracystic villous papillomata occur in the breast and ovary.

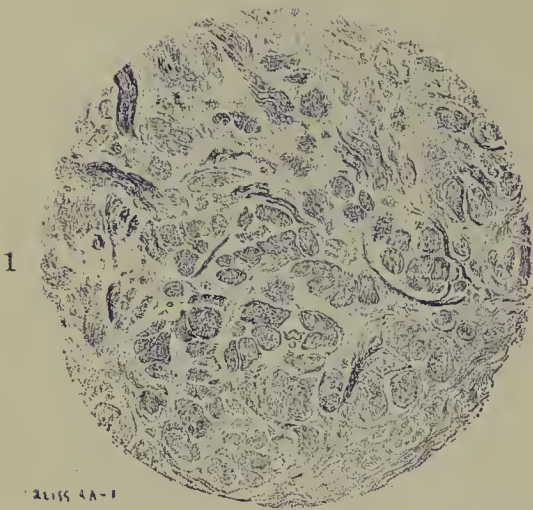
**Cutaneous Horns.**—Cutaneous horns are objects of curiosity and popular dread among the common people, and are often seen in museums. They are due to the escape of the contents of a sebaceous cyst, which becomes dried and is pushed further out by its collection of new material.

**Epithelioma.**—An epithelioma is a proliferation of stratified epithelium which has broken through the basement membrane, and in these situations shows the presence of epithelial nests. These tumors are peculiarly liable to occur in those places where one kind of epithelium joins another, as at the junction of the mucous membrane of the eye, mouth, or anus with the skin. The term epithelioma is often used as a synonym for cancer, but the latter tumors originate from glandular structures. Epitheliomata are often caused by irritation, as in the pipe-smoker's epithelioma of the lip and the now almost extinct variety of chimney-sweeper's epithelioma of the scrotum. They are malignant tumors, prone to recurrence, and give metastasis by the lymph-channels, though not to so great an extent as cancer. Their first appearance may be as a wart, fissure, or nodule. Fantastic shapes are often assumed, as on the penis, when they have attained considerable size.

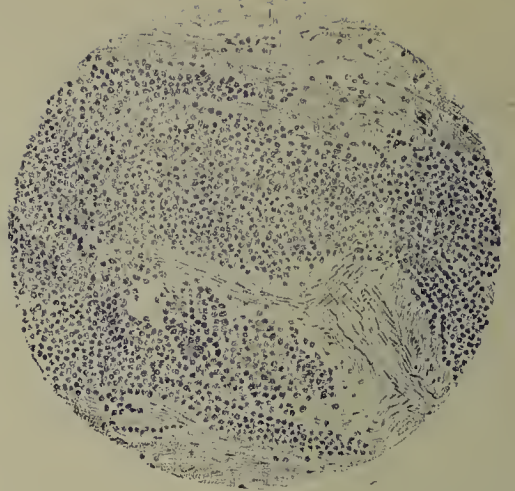
**Adenoma.**—An adenoma imitates, but does not fulfill, the function of the secreting gland in which it is found. The situations where adenomata are found



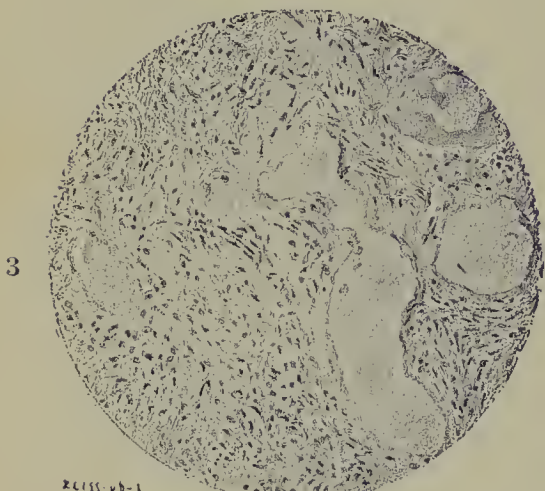




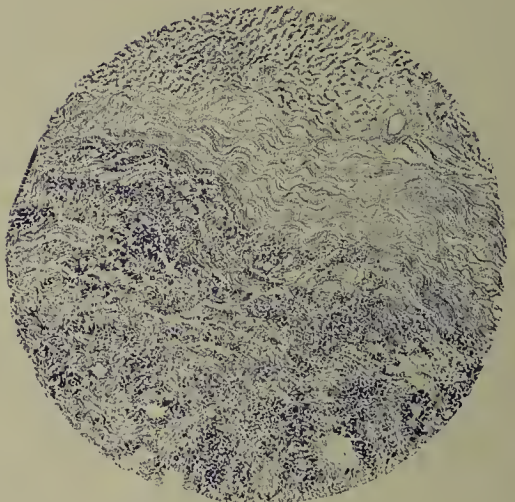
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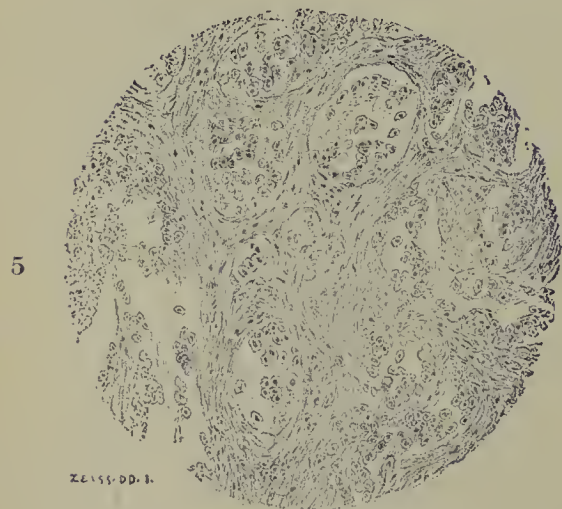


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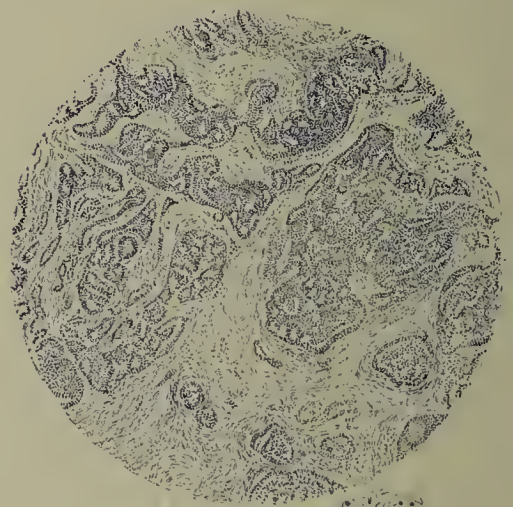


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1, False neuroma. 2, Round-celled sarcoma of the heart. 3, Osteosarcoma of the jaw.  
4, Melanotic sarcoma of the liver. 5, Alveolar sarcoma. 6, Cancer of the uterus.



are given in the classification of tumors.

**Carcinoma.** — Cancers arise from a malignant proliferation of glandular tissue, the cause of which is at present unknown. They at first resemble adenomata in their growth, but gradually become less and less like the glands from which they originate, until irregular clumps of epithelial cells have broken through their lining membrane and are to be found collected in the acini and ducts.

Carcinoma may develop from the tissues normally present. Parasites, if present, have no more etiological significance than any other form of chronic irritation, and hence there are no specific organisms of carcinoma. H. S. Olney (Detroit Medical Journal, July, 1904).

In explaining to students the differences between a normal gland, adenoma, and cancers the following simile is often

employed by pathologists: A gland may be likened to a dwelling-house complete in every detail, the acini being the room, the ducts the passage-way, the connective tissue the frame-work, and the epithelium the plaster upon the walls. Following this simile, an adenoma may be regarded as an architecturally atypical house in which there has been a purposeless addition of rooms or halls, but in which each addition still shows, more or less clearly, the normal frame-work and plaster. In cancer the arrangement is as if the house had collapsed and the plaster (epithelial cells) had broken through the walls (connective tissue) into the rooms (acini) and halls (ducts), and then all of the constituents had grown in a conglomerate sort of a fashion, involving first the neighboring houses (tissues) and finally affecting those houses (other organs) at a distance (metastasis).

The contrast between sarcomata and carcinomata is shown in the following table of differences:—

*Sarcomata.*

1. Are of a connective-tissue type and are composed almost entirely of cells imbedded in an homogeneous or reticular matter. Rarely forms alveoli.
2. Cells endothelial, embryonal, or lymphoid.
3. Acetic acid and caustic potash almost dissolve them.
4. Blood-channels without muscular walls, running free between the cells. Small hæmorrhages common.
5. No fat within tumor proper. Often capsulated.
6. Metastasis by the blood-vessels.
7. May affect lymph-glands primarily, but not by metastasis.
8. Develop in connective-tissue substance. Deep-seated and grow upward.
9. Skin not adherent unless through associated inflammation.
10. Not usually painful.
11. Grow in young, well-nourished individuals chiefly.

*Carcinomata.*

1. Are of both a connective-tissue and epithelial type and are composed of cells lying free in the alveolar spaces formed by pre-existing connective tissue.
2. Cells exclusively epithelial. Distinct nuclei and nucleoli.
3. Acetic acid and caustic potash have no such effect.
4. True blood-vessels and also nerves running only through the connective-tissue frame-work.
5. Fat may be seen within the cancer-tissue. Rarely capsulated.
6. Metastasis by the lymphatics, though in later stages may spread with great rapidity by the blood-vessels.
7. Do not develop in lymph-glands primarily, but affect them by metastasis.
8. Develop from epithelium. Usually peripheral and grow downward.
9. Skin frequently adherent.
10. Painful.
11. Grow chiefly after middle life.

*Sarcomata.*

12. Do not often give history of heredity.
13. Grow rapidly.
14. No micro-organism yet described.
15. Juice absent or seen first some hours after removal.
16. Flesh-like, rounded, or bosselated, and regular masses. On section, smooth, pearly surface, often of a reddish tinge.
17. Infiltration of surrounding tissue when present is best seen with the microscope.
18. Pigmentation common. Osteosarcoma of bone reaches very large size.
19. Rarely interferes with the venous and lymphatic circulation.
20. Situation and order of frequency of the primary growths: corium, fasciæ, intermuscular septa, bone, periosteum, brain, ovary. Rare in liver, lung, uterus.
21. Myxomatous degeneration common.
22. Fat-cells apparently are converted at times into sarcomatous cells.
23. Cachexia rare and comes on later.
24. Diagnosis not aided by blood-count.
25. Sarcoma breaks down from extrinsic causes.

Oöphorectomy or an abdominal section at times may cause a malignant tumor to become inactive or even to decrease in size. Again, the prompt diagnosis of cancer of the body of the uterus is most important, as an early hysterectomy is attended with the most beneficial results, while the operation is almost hopeless after the disease has invaded the cervix. On the other hand, Gould (Trans. Clin. Soc., vol. xxx) reports a case of spontaneous disappearance of secondary cancerous growths in the female breast.

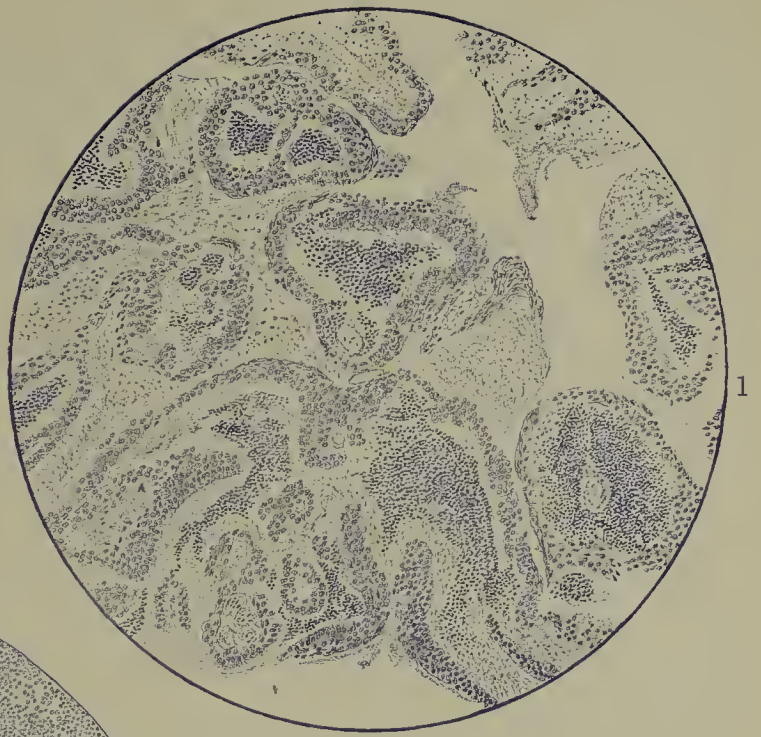
*Carcinomata.*

12. Often hereditary. Cancer-houses exist where occupant after occupant develops cancer.
13. Grow slowly.
14. Due to some organism, such as yeast, psorosperm, etc.
15. Juice can be expelled.
16. Nodular and irregular, often ulcerating surface, with fungoid borders and induration of the floor of the ulcer. On section, more granular; opaque; less reddish.
17. The malignancy of cancer is greater than that of sarcoma, the growth infiltrating into the surrounding tissue.
18. Pigmentation rare. Primary cancer of bone probably does not occur. Common in bone by metastasis and may render bone so brittle that it breaks with the application of the slightest force.
19. Often causes œdema and pressure outpouring of fluid.
20. Epithelial surfaces and glands—lips in male, vaginal portion of uterus, breast, stomach, intestine.
21. Colloid, mucoid, and cystic changes common.
22. Fat-cells are pushed aside or are used up in supplying nutriment to the invading cells.
23. Cachexia common, especially after metastasis has taken place.
24. Leucocytosis often increased.
25. Cancer shows intrinsic degenerations almost from the start.

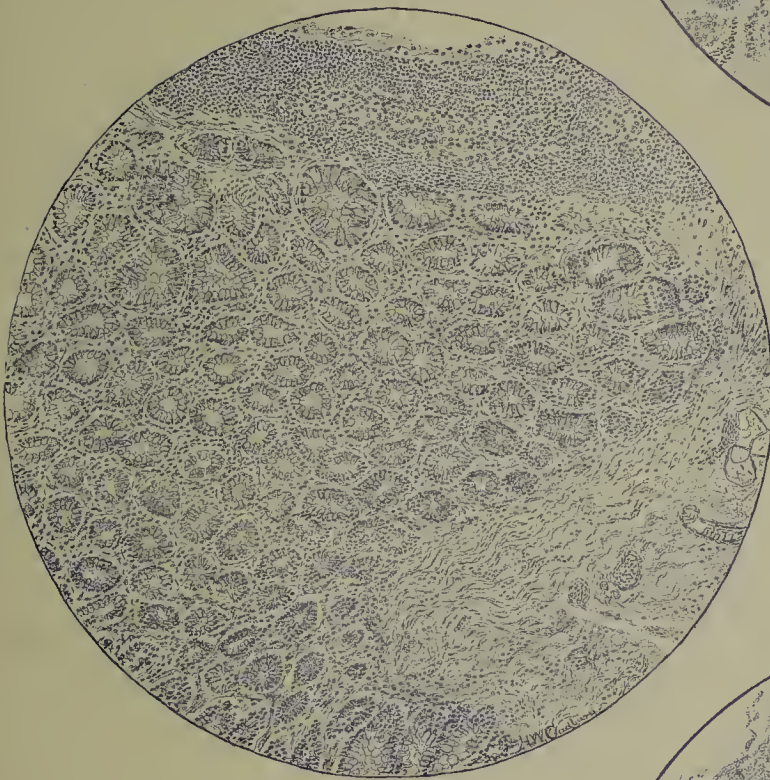
Snow (Lancet, Jan. 9, '97) believes that infection of the marrow of the bones occurs in nearly all cases of cancer of the breast, the humerus being the first bone affected, as manifested, after the disease has existed eighteen months, by tenderness on pressure, and possibly slight thickening may be made out. The result is a firm, white marrow.

Babès and Stoicescu (Ann. de l'Inst. de Path. et de Bact. de Bucarest, vol. vi, p. 405) believe that it is possible to diagnose the presence of cancer of the inter-

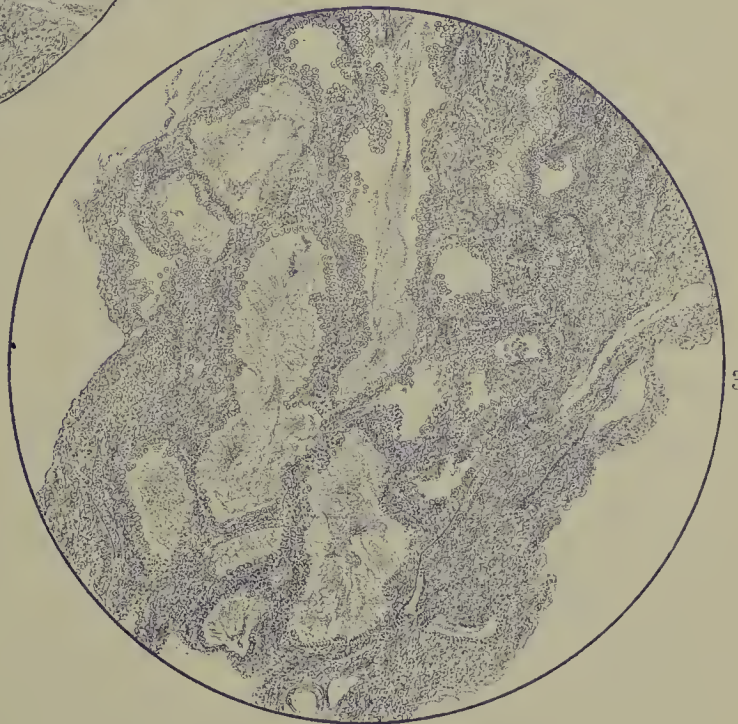




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3

1, Cancer of the uterus from scrapings obtained by means of a curette. 2, Adenocarcinoma of the rectum (Kraske operation). 3, Scraping from the uterus following an abortion.





nal organs by a microscopical study of the small cutaneous masses which sometimes appear by metastasis beneath the skin of the patients so affected.

Keen, in his lectures, alludes to a case in which skin-grafting from the thigh was practiced upon the breast where a carcinoma had just been. A cancerous nodule developed at the place from which the healthy skin was taken, no doubt from direct infection from the breast.

After three years' work in the New York State Pathological Laboratory of the University of Buffalo, the writer has found what he regards as the cause of cancer. In all the cases of cancer so far examined it has been noted that by fresh methods the organisms can always be found. These bodies resemble fat in the fresh state. It was only when the ether test and the osmic-acid test had been applied that it was discovered that they were not particles of fat. He next discovered that he could crack their edges with the cover-glass. They were then injected into the abdominal cavities of animals. Most of the animals developed peritonitis, and large quantities of these bodies could be obtained from the peritoneal fluid. The round form may be observed to develop under the cover-glass. They can be found in every cancer if properly sought for, and can be injected into animals and be recovered. They also change their form.

In the centre of carcinomata which have undergone degeneration the fluid, the so-called cancer-milk of the older writers, consists practically of a pure culture of these organisms. The fluid from malignant ovarian cysts likewise contains a large number of the organisms, and the peculiarly characteristic mush found in the cavities of certain adenocarcinomata of the ovaries is likewise largely composed of the various forms of the parasite. This shows that bodies identical in appearance to those found in the peritoneal fluid of the first case mentioned can be found in all scrapings of cancer. The small, highly-refractive form which in suspension possesses a characteristic oscillating mo-

tion, the larger pale forms projecting pseudopodia, and the saccular forms containing highly-refractive spherical bodies could be detected with equal facility in the fresh scrapings of any malignant tumor. H. R. Gaylord (*Amer. Jour. Med. Sci.*, May, 1901).

The parasitic theory of the etiology of carcinoma cannot stand. It can—as yet, at any rate—be brought into relation with only one group of malignant tumors. The infectious pathogenic agents produce reactive inflammatory conditions, while in carcinoma the metastases are produced by tumor-cells that cause no reaction of infection in the surrounding tissues. It is extremely difficult to explain how the parasites could reach the region in which carcinoma arises, except in those instances in which it is situated at points directly accessible to the exterior. If parasites cause the disease, one would expect carcinoma of the breast to be practically always situated near or on the surface; but this very often is not the case. As to the parasites described by a large number of investigators recently, and variously considered to be protozoa and blastomycetes, reference is made to Nösske's work, which demonstrates that they are cell-inclusions of another nature. The only satisfactory conclusion that can be reached is that the malignancy of certain tumors is explainable only upon the basis of the production of toxic substances in the life-activity of the cells, which produce alterations in the cells that interfere with their normal metabolism and with their normal structure. This change in the cells may be very different in grade and in quality. The resistance of the normal organism to the unchecked growth of its elements might be explained through the fact that normally the specific substances which favor their growth—or which damage surrounding tissues, and thus give them opportunity for growth—are neutralized. In the case of malignant tumors, however, these substances are not neutralized. Marchand (*Deutsche med. Wochen.*, Oct. 2, 1902).

It is claimed by investigators who believe that cancer is due to parasites: 1. That a proliferation of the epithelial cells

analogous to cancer can be produced by certain protozoa (nodules due to coccidium oviforme). 2. That certain skin lesions characterized by epithelial-cell proliferation are due to the action of a so-called protozoan, molluscum contagiosum. 3. That blastomycetes constantly are present in human cancers and are the cause of the lesion. 4. That, by experimental inoculations of animals with blastomycetes, true epithelial or cancerous nodules can be produced. 5. Finally, that the well-known endocellular bodies seen in the protoplasm of cancer-cells have a definite morphology, are parasites, and cause cancer. It was the object of investigators whose work is here reported to study each of these questions.

General conclusions: As a result of investigation it is concluded that: 1. The lesion produced by coccidium oviforme is essentially a chronic inflammation not analogous to cancer. 2. The lesions in molluscum contagiosum show certain changes in the epidermis not due to the action of protozoa and not analogous to cancer. 3. The so-called "blastomycetes" of Sanfelice and Plimmer are torulæ. 4. The lesions produced by these torulæ are essentially nodules of peculiar granulation tissue, not cancerous or in any sense "tumors." 5. Blastomycetes are not constantly present in human cancers. 6. The cancer bodies are not parasites or the cause of the lesions, but are probably atypical stages of the process of secretion by glandular epithelium. Report of the Men Working under the Cancer Commission of Harvard University for the Year 1901-1902 (*Amer. Jour. Med. Sciences*, June, 1902).

The frequency of cancer in the various parts of the body varies in different countries, and two observers in the same city often arrive at different conclusions. In my experience, cancers of the stomach and of the breast have been about equal in number, but were collected in entirely different ways, the first while making over 2000 autopsies and the latter being received by me for microscopical study. In 1266 cases of cancer (and epitheliomata) collected by Munn for the records

of the Middlesex Hospital, 426 were of the uterus and 417 of the breast. In France cancer of the stomach seems to head the list in point of frequency.

Study of the heredity of cancer based on 23 families, in which several members were affected. In these 23 families there were 69 cases of cancer, distributed as follows: 57 in the stomach, 4 in the uterus, 3 in the breast, 3 in the rectum, 1 in the bladder, 1 in the liver. Of the 57 cases occurring in the stomach, 41 were in males, 16 in females. In 11 families the heredity was exclusively in the male line, in 5 in the female; in 6 families both sexes were equally affected. Moreover, 14 out of 22 families showed cancer in the stomach, and of these the males were affected in 8. It appears, therefore, that heredity in cancer should be no longer doubtful. The special form of cancer is itself hereditary. Manichon (*Jour. de Méd.*, Sept. 10, '96).

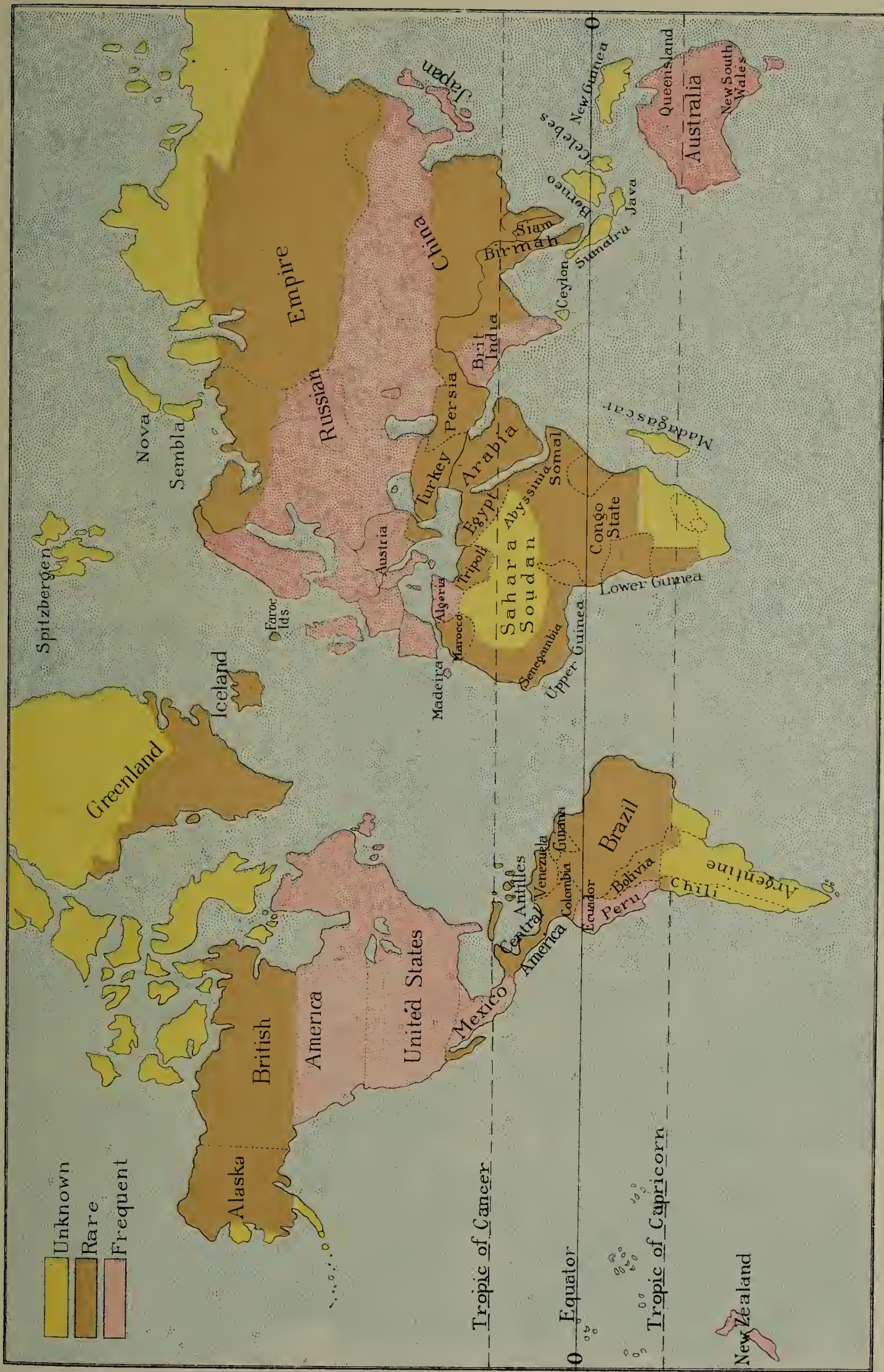
Robert Behla (*Centralb. f. Bakt.*, Nov. 25, '99) has made some interesting studies in regard to the geographical distribution of cancer. (*See Plate 1.*)

In San Francisco the ratio of cancer-mortality has crept up from 16.5 cases in 100,000 population, in 1866, to 103.6 cases to 100,000 population, in 1898. In Boston the rate has trebled in the twenty-four years between 1863 and 1887. The combined cancer-mortality of the seven largest American cities, exclusive of Chicago, has doubled in 28 years. There are at least 100,000 persons suffering from cancer in the United States at the present time. During 1898 it caused 49,800 deaths. G. B. Massey (*Amer. Jour. Med. Sciences*, Feb., 1900).

The increase of cancer has been marked in the past fifty years. In England and Wales during the last twenty years deaths from cancer more than doubled. In New York State cancer is the only disease tabulated which shows a progressive and steady increment. The greatest increase in this country is in San Francisco. J. C. Warren (*Boston Med. and Surg. Jour.*, July 12, 1900).

In a series of 7790 autopsies, performed during a period of six years at a Berlin hospital, 711 cases presented a patho-









logical diagnosis of carcinoma. In 156 cases—almost 22 per cent.—the diagnosis could not be or was not made before death. Considering the susceptibility of the sexes, it seems that in general both are about equally affected. If, however, the varieties of tumor peculiar to each sex are eliminated, the proportions change, the male being the more often afflicted. The male sex is more susceptible to carcinoma of the œsophagus, stomach, larynx, lungs, and face, the female to carcinoma of the genitals, gall-bladder, and mammæ. A large number of cases found in which the bronchi, the lungs, or the pancreas were involved. The increase in the number of cancer cases may be accounted for by the fact that a greater number of persons reach the susceptible age by the improved methods of diagnosis. W. Riechelmann (*Berliner klin. Wochen.*, Aug. 4, 1902).

In seeking to learn the causes of cancer, attention must be directed to the influence of climate, soil, race, age, sex, occupation, heredity, alimentation, other diseases, etc. It is distributed by stagnant water or by floods, by the use of such water for domestic purposes, by eating of uncooked vegetables, such as salads and celery, by contact with infected animals, by the fungoid growths upon trees standing on the banks of streams due to taphrinoid and nectrioid chytridiaceæ, or by blood-sucking insects, etc.

In all cases of malignant disease there is a precancerous stage. Cancer is of local origin. Heredity as a factor in etiology is unimportant. In over 500 cases of cancer where careful investigations were made and the question of heredity was given the benefit of every possible doubt, less than 5 per cent. was found where it was claimed that there had been a history of cancer in the family. Daniel Lewis (*Med. Rev. of Rev.*, June 25, '98).

That cancer is not a disease of the poor and poorly nourished is shown as follows: 1. The improvement of the condition of the people in England has doubled in the last 150 years, poverty is one-half

less; but, despite this, cancer has increased fourfold. 2. The mortality from cancer is least among the poor and greatest among the rich. 3. In Ireland, where people are as poor now as 50 years ago, cancer has not increased. Williams gives overnourishing and an easy life as predisposing causes. In rich West London the cancer mortality is twice that in the poor district of East London, while among savages it does not exist. Of 325 cases of cancer in females, none were in prostitutes; and of 160 cases only one patient had had syphilis. (Williams); 25,000 women out of 25,000,000 in Germany die of cancer uteri; of these only 10 to 30 per cent. are operable, and only one-third or one-fourth of the operable ones remain free from a return; hence only one-tenth of all cases of uterine cancer are saved from death by operation. Duhrrsen (*Deut. med. Woch.*, Jan. 26, '99).

Limestones are always associated in England and Wales with the lowest mortality from cancer, and flooded clays with the highest. Alfred Haviland (*Practitioner*, Apr., '99).

Cancer is rarely associated with tuberculosis in the same individual; this is, perhaps, partly due to the different ages at which these diseases occur. Tuberculosis is found everywhere; carcinoma is not found in certain areas, as in the polar regions. Cancer is undoubtedly on the increase in Great Britain, and in certain sections of America: *e.g.*, Buffalo, N. Y. Cancer is found at an earlier age than formerly, though this is possibly due, in some cases, to earlier diagnosis.

Attention called to the increasing mortality from carcinoma in recent years. The increasing prevalence of carcinoma in England and Wales since 1840 and the relative increase among males and females is as follows: In 1840 carcinoma caused 2786 deaths, the proportion being 1 in 5646 of the total population and 1 in 129 of the total mortality, or 177 per million living. In 1896 the deaths due to the same disease numbered 23,521, or 1 in 1306 of the total population

and 1 in 22 of the total mortality, or 764 per million living. No other disease can show anything like such an immense increase. It is believed that this increase may be in part due to the excessive consumption of meat of late years. Statistics show that more than double the amount of meat is consumed at present than there was fifty years ago. Insufficient exercise and deficient fresh vegetable food may also have an influence. The heavy mortality at advanced ages may be due to the survival in increased numbers of weakly lives artificially prolonged by improved conditions of existence. The increased frequency in males may be due to the increasing urban population, the men living under conditions resembling more closely those for women than heretofore. W. Roger Williams (Lancet, Aug. 20, '98).

Statistical data available do not justify the conclusion that an increase in cancer mortality has occurred within recent years. They rather tend to the conclusion that the increase in cancer is only apparent, and is due to improved diagnosis and more careful certification of the causes of death, especially to the latter. However, absolute proof is out of the question with such imperfect data. This conclusion only applies to the last forty years.

Cancer causes about 6 per cent. of the total deaths registered among males at ages over forty-five, and over 7 per cent. of the total deaths registered among females at ages over forty-five. Were the real facts known, it would be found that the number of deaths due to cancer is even greater than these figures indicate. Arthur Newsholme (Practitioner, Apr., '99).

*Specimens.* — When it is decided to have a tumor studied by a pathologist, the entire mass removed should be sent to him in as fresh a condition as possible, with as much of the history as will assist him in making a diagnosis. Too many surgeons show a disposition to conceal facts bearing upon the case, as if the pathologist were not to be trusted with them. The pathologist is an expert,

and as such should be treated with the same consideration as any consultant. If the tumor cannot be forwarded in a fresh state, it should be placed in weak alcohol (from 40 to 50 per cent.) or weak formalin (from 1 to 2 per cent.) in a filled jar at least five times the size of the specimen.

On the occurrence of any turbidity of the fluid or reddening of the tissues, especially where they rest upon the bottom of the jar, the fluid should be immediately changed. When a portion of the tissue is saved for microscopical study alone, it is of the greatest importance that it should be taken from the margin of the tumor, and, when possible, should include a portion of the surrounding normal tissues. Such a piece need not exceed the size of the tip of the index finger, but its relations to the body and to the tumor should be very carefully noted.

One or two such pieces may be placed in a wide-mouthed four-ounce bottle, well stoppered, containing 95-per-cent. alcohol, 3-per-cent. formalin, saturated solution of bichloride of mercury, or Müller's solution. A very satisfactory solution is that composed of equal parts of a 3-per-cent.-formalin and 3-per-cent.-bichromate-of-potassium solution. The mixture should be made fresh when needed, and changed every day, when the pieces should be thoroughly washed in running water three or four hours and then placed in alcohol, 1 part, and water, 2 parts. If any discoloration occurs, the specimens are to be again washed and placed in the alcohol. This is to be repeated until the alcohol remains clear. If the specimen has become dried, it should be placed in water and when it resumes its normal size, alcohol should be gradually added until sufficient strength has been reached to preserve



the tissue. Frozen sections from a tumor or uterine scrapings may be made with ether, carbon dioxide, or ethyl-chloride (see article by the writer in the *Internat. Med. Mag.*, Dec., '96), stained, and mounted, under the most favorable conditions, in ten minutes from the time of removal of the tumor or a portion of the tumor from the body. The advantages of this are evident. The pathologist can be present at an operation, and the microscopical findings will often be sufficient to decide, while the patient is still under the ether, whether a limb will have to be amputated, a hysterectomy performed, or the axillary glands thoroughly removed. Care must, of course, be taken that the decision be not a hasty one; but very often the surgeon must decide this very thing at the time of the operation, and considerable assistance may be afforded him by the opinion of a competent microscopist as to the immediate procedures to be taken.

### III. Dermoids.

True dermoids are composed only of tissues found in the skin and mucous membrane. Sequestration dermoids, etc., are due to squeezing off of tissues where the lateral halves of the body coalesce. Implantation cysts are mechanically produced by the introduction of some tissue into a place where it does not belong and its further growth there. They are found especially in the fingers of persons who make their living by sewing. Tubulo-dermoids are etiologically associated with canals which were used in foetal life; thus, the thyro-lingual duct, the post-anal gut, and the branchial clefts give rise at times to this variety of dermoids. Ovarian dermoids possess the greatest size and variety of contents, but when other tissues than those of the skin are found they must be regarded as more purely teratoid growths, which oc-

cur not only here, but elsewhere in the body. Thus, Woodhead's case ("Practical Path.," '92) of the ovary contained nerve-fibres, multipolar cells, ganglion cells, etc., and does not properly belong here.

### IV. Cysts.

Cystomata are caused by the abnormal dilatation of ducts or cavities already formed. They may contain one of the products usually found—bile, saliva—or modified products. The last gives their situation, but, as they are hardly tumors in the true sense of the word, they are not described in this section.

**Treatment.**—The various methods of treatment have been reviewed in various parts of this work, and the reader is therefore referred to the INDEX.

For the treatment of malignant growths, however, the trend of modern thought but emphasizes the teachings of Gross, that the method of choice should be removal by surgical means as soon as possible, if this be practicable.

Coley's mixture of the toxins of erysipelas and bacillus prodigiosus is sometimes useful in inoperable sarcoma.

Conclusions in regard to the use of erysipelas toxins in malignant disease of the New York Surgical Society: 1. That the danger to the patient from this treatment is great. 2. Moreover, that the alleged successes are so few and doubtful in character that the most that can be fairly alleged for the treatment by toxins is that it may offer a very slight chance of amelioration. 3. That valuable time has often been lost in operable cases by postponing operation for the sake of giving the method of treatment a trial. 4. Finally, that if the method is to be resorted to at all, it should be confined to absolutely inoperable cases. L. A. Stimson, A. G. Gerster, B. F. Curtis (*Annals of Surg.*, July, '96).

Conclusions in regard to Coley's treatment of inoperable sarcomata:—

1. There is a considerable number of cases in which sarcomata that had been

given up as hopeless often after repeated operations have absolutely and entirely disappeared under this method of treatment.

2. In some of these cases the patients have remained free from recurrence for upward of three years.

3. In several of the cases in which sarcomata have disappeared after an attack of erysipelas the patients have remained free from recurrence for seven years and upward.

4. The proportion of cases of sarcomata in which the patients are cured by the injection of the mixed toxins depends, among other things, upon the histological character of the growths. Spindle-celled sarcomata are the most hopeful.

5. The disappearance of sarcomata is not due to inflammation, but to an intensely rapid form of fatty degeneration.

6. Degeneration and absorption may occur whether the toxins are injected directly into the tumor or into some distant part of the body. In the former case the effect is more rapid and the constitutional symptoms are more severe.

7. The method is attended by a considerable degree of danger. It should, therefore, only be adopted in those cases for which there is no other remedy. The chief risk appears to be from collapse and pyæmia.

8. The toxins are of no use unless the cultures are taken from a virulent case of erysipelas or are made virulent by passing the streptococcus through rabbits.

9. The bacillus prodigiosus immensely increases the reaction.

10. The effect is most striking in the case of rapidly growing sarcomata.

11. Treatment should be continued until the whole growth has vanished or has become so small that it can be removed.

12. If there is a recrudescence of the disease it does not follow that the toxins will be as efficacious the second time as they were the first.

13. Recurrence in other parts of the body may take place after many years. C. Mansell Moullin (Lancet, Feb. 5, '98).

Conclusions in regard to the treatment of malignant tumors with the mixed toxins of erysipelas and bacillus prodigiosus are as follow:—

1. The mixed toxins of erysipelas and bacillus prodigiosus have an inhibitory action upon the growth of malignant tumors of whatever variety.

2. This influence is far more marked in sarcoma than in carcinoma, and differs very markedly in the different varieties of sarcoma, being most pronounced in the spindle-celled variety, and least in the melanotic.

3. A considerable number of inoperable sarcomata, the correctness of the diagnosis of which is beyond question, have entirely disappeared under this method of treatment.

4. A large portion of these cases have remained free from recurrence more than three years after treatment.

5. The action of the toxins upon sarcoma must be regarded as a rapidly progressing necrobiosis, with fatty degeneration.

6. This method of treatment is attended with some risk unless certain precautions are taken. These risks are: (a) collapse from too large a dose, especially when injected into a very vascular tumor; (b) pyæmia from insufficient care as regards asepsis, especially in the presence of a granulating or sloughing surface. That these risks are slight is shown by the fact that, in upward of two hundred cases of malignant tumor treated personally, death occurred in but two as a result of the treatment.

7. The use of small doses of the toxins for a short time after primary operation as a prophylactic measure theoretically has much to recommend it.

8. The action of the toxins upon sarcoma, as shown by the clinical results, is in strict accordance with the known action of the living streptococcus of erysipelas. Hence the method rests upon a perfectly logical and scientific basis.

9. The toxins, to be of value, must be prepared from highly-virulent cultures of the streptococcus of erysipelas. Coley (Practitioner, Apr., '99).

Statistics of 115 cases of inoperable



malignant growth treated with erysipelas toxin. Of these, 62 were sarcomas and 53 carcinomas. Of the 62 sarcomas, 11 were cured (Kleeblatt, 1; Mynter, 1; Coley, 9): a proportion of 17.74 per cent. Twenty-eight cases were considerably improved (Spronk, 8; Friedrich, 1; Coley, 19), or 45.16 per cent. The other 23 cases showed a temporary improvement, or failed to respond. Of the 53 carcinomas, 22, or 41.5 per cent., showed some temporary improvement, and the rest (31 cases) gave completely negative results. Filippo Scuderi (*Gazzetta Med. Lombardi*, June 10, 1900).

Any growing tumor of the breast should be removed, and any angiomatous spots (spider patches) should be watched, and, as soon as they start growing, should be gotten rid of, more for cosmetic reasons than for fear of harm to the functions of the organ.

[For x-ray treatment see various anatomical subdivisions: TUMORS OF BREAST, etc.]

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Philadelphia.

### TUMORS OF THE BRAIN.

**Symptoms.**—The symptoms of a tumor of the brain vary according to the size of the growth, its location, the rapidity of its development, the age of the patient, the character of the tumor, and the indirect effects on distant portions of the brain. These may be classed as general and focal. Usually the former are the first to attract the attention of the patient, but occasionally the manifestations of the latter are the first to cause him to seek the advice of a physician. The general symptoms are usually headache, intermittent or constant, with periods of exacerbation, going on for weeks or months before dizziness, nausea, and apparently causeless vomiting are complained of; not infrequently disturbance in vision or a general convulsion occurs before or soon after the

headache has become severe enough to interfere with the comfort of the patient. In the cases in which focal symptoms have been the first to appear, convulsive movements, limited to a group of muscles, to one limb, or to one side of the body, or symptoms of speech-disturbance lead the patient to seek relief. As the disease advances the early symptoms become more marked, and numerous others are added, much to the discomfort and incapacity of the patient. Headache, if not severe before, soon becomes agonizing; vision gradually or rapidly lessens; vomiting often occurs with or without nausea, especially in early morning, when the lesion is situated in the posterior fossa or at the base of the brain, and the patient may become greatly emaciated; sustained mental effort is impossible, both on account of the headache which it usually augments and on account of the mental deterioration resulting from brain-disturbance; walking may become difficult or impossible, either from paralysis or from interference with muscular co-ordination, the latter usually being due to a growth in the posterior cerebral fossa, the cerebellum, or in the region of the corpora quadrigemina; there may be disturbances of special and general sensory phenomena. Various respiratory and circulatory irregularities may be present. Usually the patient becomes stuporous and finally comatose before death takes place. In a few cases convulsions cause death before the patient dies from exhaustion.

Among the general symptoms, headache, double optic neuritis (choked disk), vomiting, vertigo, and general convulsions are the most important.

HEADACHE is often the earliest symptom, and is usually one of the most prominent, constant, and distressing. It

is present in from 75 to 95 per cent. My own experience leads me to believe that it is rarely absent throughout the course of the disease. It is less constant and less severe in certain gliomatous growths. It often intermits, and may be absent for prolonged periods, especially while the patient is taking large doses of potassium iodide, although the tumor may not be syphilitic in character. The headache is often agonizing, especially during the periods of its exacerbation. In some cases the pain is so great, especially in subtentorial tumors, as to cause death in a few weeks, or, at most, in a few months, from the time that the headache becomes prominent. It is usually worse at night. In many cases, while the pain is sufficient to interfere with sleep and mental exertion, it is much less intense than in the severer ones. In not a few the pain amounts to little more than an uncomfortable cephalic fullness or tightness, with an occasional exacerbation. The pain may be lancinating, rending, stabbing, dull, heavy, or boring in character. It is usually most severe when the tumor is rapidly growing, when situated at the base below the tentorium so as to exert pressure on the veins of Galen, or in the cortex; least severe in slowly-growing tumors, especially when situated in the centrum ovale. The pain may be increased by anything that augments the blood-supply to the brain. It may be diffused or limited to one or more regions of the brain. Its location is no positive indication of the seat of the tumor, except in those cases in which the growth is superficial and involves the membranes, when the pain, and tenderness on percussion, may correspond to the seat of the morbid process. Tumors in the frontal region less frequently give rise to occipital pain than

a growth in the posterior portion of the brain causes frontal headache. A persistent occipital or suboccipital pain usually points to a subtentorial growth, and, in these cases, pain often radiates down the posterior cervical region. A tumor in one cerebral hemisphere may give rise to pain in the opposite side of the head and nowhere else; but a unilateral occipital headache usually corresponds to the side of the head on which the growth is situated.

**CHOKED DISK, OPTIC NEURITIS, AND OPTIC-NERVE ATROPHY.**—Choked disk, or optic neuritis, while not usually an early symptom, occurs in over 80 per cent. of the cases of tumor of the brain. It begins acutely, and only a few days or weeks may elapse from its first appearance until it has reached a degree of considerable intensity. An ophthalmoscopic examination may reveal it while vision is still well preserved. It is usually bilateral, but the morbid process is further advanced in one eye than in the other. When it is unilateral the indications are that the disease is anterior to the optic chiasm. Knies states that "simple neuritis, terminating in atrophy, is found less often than choked disk in cerebral tumors." According to this writer, it happens in tumors of the frontal lobe in which the tumor is close to the optic nerve. In all such cases the disk is choked to a greater or less extent, and when the stage of atrophy has set in the sinuosity of the vessels near the disk will be the only means by which to determine the secondary nature of the atrophied nerve. Primary atrophy of the optic nerve probably does not occur as a result of tumor of the brain.

Choked disk seems to occur less frequently in tumors of the medulla, and of the centrum ovale of the middle and anterior portions of the brain; most fre-



quently when the growth is situated in the cerebellum, the corpus callosum, the corpora quadrigemina, and the great ganglia, or at the base of the brain.

VOMITING, a frequent symptom of tumor of the brain, occurs most commonly when the growth is large and rapidly growing, situated in the cerebellum near the middle lobe or in the neighborhood of the corpora quadrigemina. It is a prominent symptom in about one-half the cases, often associated with severe headache, and may be projectile in character, and not associated with taking food or with nausea. When the growth is so situated as to affect the middle lobe of the cerebellum or corpora quadrigemina, vomiting may be produced by any sudden movement of the patient's head. Vertigo in many cases is unassociated with vomiting, but it may be a very annoying symptom, and almost constant, yet unattended by vomiting. Like the latter, it is most frequent in tumors of the cerebellum and adjacent parts. A general convulsion may precede other symptoms or it may occur at any stage of the disease. It is found in about one-third of the cases, and denotes active progress of the disease. General convulsions rapidly following each other late in the disease may prove fatal. Mental disturbance, insomnia, somnolence, and syncope are found in many cases.

FOCAL SYMPTOMS may be direct and result from the invasion of a portion of the brain by the growth, or indirect and due to its interfering with the function of structures more or less distant from the tumor. Both sets of symptoms are frequently present and prominent at the same time, requiring great care to separate the one from the other.

Incomplete hemiplegia, monoplegia, limited convulsive movements (Jacksonian epilepsy), paralysis or spasm of sin-

gle muscles or groups of muscles, and contraction are the local disturbances in motility that may result from tumor of the brain. There may be, also, various perversions of the sensory phenomena, hemianopsia and aphasia, depending upon the seat of the growth.

The COURSE and DURATION of intracranial growths are variable, depending upon the character of the tumor, its location, and the complications. The symptoms are usually gradual in their development, in a few rapid, and in others they are arrested for several months. Some tubercular growths may apparently run their course in a few weeks on account of the presence of meningitis, while others extend over a period of years. In a few cases, after a growth has gradually progressed several months or a year without any very alarming symptoms, death may suddenly occur with symptoms of a vascular lesion. The average duration of tumor of the brain is about fifteen months, but the variation is from a few months to two or three years, or even a greater length of time.

**Diagnosis.**—The first problem for the diagnostician to solve in a case is: Are the symptoms due to organic intracranial disease? When an organic lesion develops in a nervous subject, symptoms, functional in character, will be added to those of organic disease. Hysteria and organic disease are not infrequently found in the same subject at the same time. A multiplicity of symptoms pointing to hysteria is of less importance in enabling one to make a diagnosis than the presence of one symptom organic in origin. As a rule, symptoms that are usually regarded as organic when caused by functional disturbance are temporary and fleeting in character, and the opposite, while true in the vast majority of cases, finds a notable exception in

multiple sclerosis of the central nervous system. Marked muscular wasting in the distal portion of a paralyzed limb of cerebral origin, associated with flexor contracture and decided increase of the deep reflexes over those of the corresponding limb of the opposite side; most cases of crossed paralysis or pronounced trophic disturbance in one or both eyes, of cerebral origin; more than transient lateral homonymous hemianopsia or sensory aphasia, may be regarded, in the vast majority of cases, of organic origin, although only one of these conditions exists. There are other and more frequent symptoms which are always very strong evidence of organic brain disease, but not positive proof of it. Among these the first in importance is optic neuritis, or choked disk. The latter may be due to tumor, renal disease, lead encephalopathy, or pronounced anæmia. The first condition named produces much more swelling of the disks than is found resulting from any of the last three; besides, in the latter, there are evidences of either renal disease, lead poisoning, or anæmia. Intraventricular effusion or abscess of the brain may cause choked disk, but these diseases have their distinct symptoms. It must be borne in mind that organic brain disease may be present in a person suffering from disease of the kidneys, lead poisoning, or anæmia. Under such circumstances a careful analysis of the symptoms and a study of the case will enable the physician to determine the nature of the case. Persistent headache, obstinate vomiting, and vertigo are frequent symptoms of intracranial growths, but they rarely continue long unassociated with eye-changes, except possibly in tumors of the medulla. Paralysis or spasm of the ocular muscles, rapid in its development, and facial paralysis, not extra-

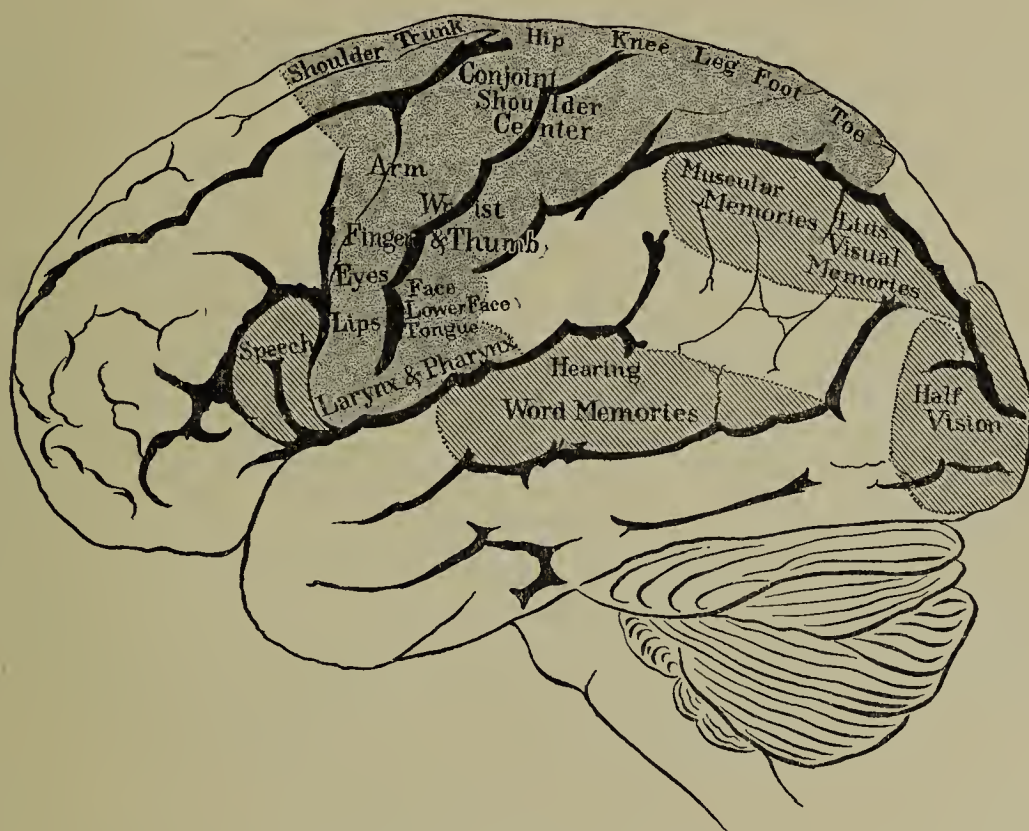
cranial in origin, are usually due to organic brain disease. In hemiplegia of organic origin the deep reflexes of the paralyzed side are greatly in excess of those on the non-affected side. This is not so in hysteria. Hemianæsthesia, including the special senses, as observed by Gowers, "is one of the rarest effects of cerebral tumors, and is absolutely unknown from this cause unless associated with loss of motor power." Whether it occurs from tumor or other forms of organic brain disease, affecting the posterior portion of the internal capsule, the lateral hemianopsia homonymous in character, will differ from the "crossed amblyopia" sometimes seen in hysteria. Persistent sensory aphasia is probably almost always due to an organic brain-lesion. Convulsions, general or local, must be seen and carefully observed by an intelligent nurse before the true nature can be determined by the physician. It is well to bear in mind that a febrile condition, simulating—by its periodicity—malaria, may occur in the course of organic disease of the brain, especially in connection with abscess, tumor attended by rapid softening of the surrounding substance, tuberculosis, and possibly syphilis.

Having satisfied ourselves that organic disease of the brain is present, the next question to determine is: Is it tumor? It is rare that tubercular meningitis is likely to be mistaken for tumor, except possibly in those cases which run a prolonged course. These are often attended with tubercular nodules or even a tubercular growth of considerable size. Under such circumstances the symptoms will partake of the character of meningitis and intracranial tumor, those of the latter predominating when the growth is large, and those of the former when the deposits are small. In those cases in



which a tumor has existed prior to the development of meningitis, not infrequently a history of attacks of apparently-causeless vomiting, attended with severe headache, may be obtained. Aneurism is diagnosticated by detecting a bruit. The principal symptoms of chronic cerebritis are headache, vomiting, and distinct optic neuritis, without localizing symptoms. This condition probably cannot be distinguished from

cular condition of the meninges attended with great thickening of the membranes to such an extent as to give rise to distinct focal symptoms is clinically indistinguishable from an intracranial tumor. Alcoholic meningitis usually affects the convexity, and tremor is present. One needs only to be familiar with the delusions of grandeur, the character of the mental failure, and other symptoms common to parietic dementia to prevent his



Brain, left hemisphere. (Dana.)

tumor of the brain unattended by focal symptoms and pronounced choking of the disks. Chronic hydrocephalus with effusion into both lateral ventricles need not be mistaken for tumor if the symptoms of each are borne in mind and the history of the case is carefully studied. Distension of one lateral ventricle with pronounced unilateral choked disk was mistaken by me for tumor in a case in which the history was unobtainable. A syphilitic meningitis or a nodular tuber-

confounding it with tumor of the brain. The same may be said of the other forms of insanity, especially mania. In multiple sclerosis the tremor is bilateral; in tumor with tremor the latter is usually unilateral. The atypical symptoms of hysteria and parietic dementia often found in diffuse sclerosis of the cerebrum will aid in preventing this disease from being mistaken for tumor. In diffuse sclerosis if the cerebellum is affected and there is staggering gait, with a tend-

ency to fall to one side, the absence of severe headache, optic neuritis, and vomiting will be against tumor and in favor of diffuse sclerosis. Chronic abscess of the brain does not cause total blindness or very marked choking of the optic disks.

What is the seat of the tumor? If the tumor is in the premotor region of the frontal lobe, there may be few positive focal symptoms. Headache is rarely so agonizing, vomiting so constant, or choked disk so frequent as in tumors in the posterior portion of the brain. My experience has been that choked disk is absent in about one-half the cases of tumor of the premotor region of the frontal lobes. The mental symptoms are the most constant, but these are variable. The patients may be apathetic, disregard the ordinary proprieties of life, and become filthy and partially demented as the disease progresses. Some exhibit a childishness foreign to their nature, and talk much of trivial things, especially when these relate to themselves; others are irritable, impatient, and at times may show a maniacal tendency; while nearly all manifest a lessened power of sustained attention and mental concentration, with absent-mindedness and lack of judgment. Amnesia is rarely complete unless the tumor is very large or both lobes are involved. If the tumor extends backward motor symptoms become manifest, and disturbances of speech are added in lesions of the left side in right-handed persons. Ataxia of the cerebellar type has been observed by a few in tumors of the frontal lobe.

TUMORS IN THE ROLANDIC, OR SO-CALLED MOTOR, REGION usually give rise to definite localizing symptoms. In the irritative stage of tumors of the cortex, these are Jacksonian epilepsy, involving the muscles of the face, arm, or leg, ac-

cording to the seat of the growth, and sensory disturbance, often in the form of auræ and numb or tingling sensations, limited to the regions involved in the convulsive movements. After the lesion becomes destructive in character, weakness or paralysis of the affected muscles takes place. As a rule, after every Jacksonian convulsion, the muscles involved in this are weak or paralyzed for a short time. The muscles first affected in the convulsion are the last to cease jerking, are the weakest, and denote the seat of the irritation in the brain. It is important to study the initial phenomena and the order in which one group of muscles after another is involved by the convulsion, as these afford aid in localizing the primary seat of the brain-lesion, especially early in the history of the disease. In some cases, probably those in which the irritation is limited to the cortex, the seizure may, for a time, consist of pain, numb or tingling sensations, limited to the distal portion of an extremity, or these may immediately precede a convulsive movement, which always begins in the part in which the sensory disturbance is first felt. When the convulsion begins in, or decidedly affects, the muscles of the lower face of either side, but most pronounced when the right is involved, temporary motor aphasia often follows the attack. Some subjective sensory loss, in the distal portion of the limb, is common in tumors of the motor cortex. According to Dana, the sense of localization is most affected.

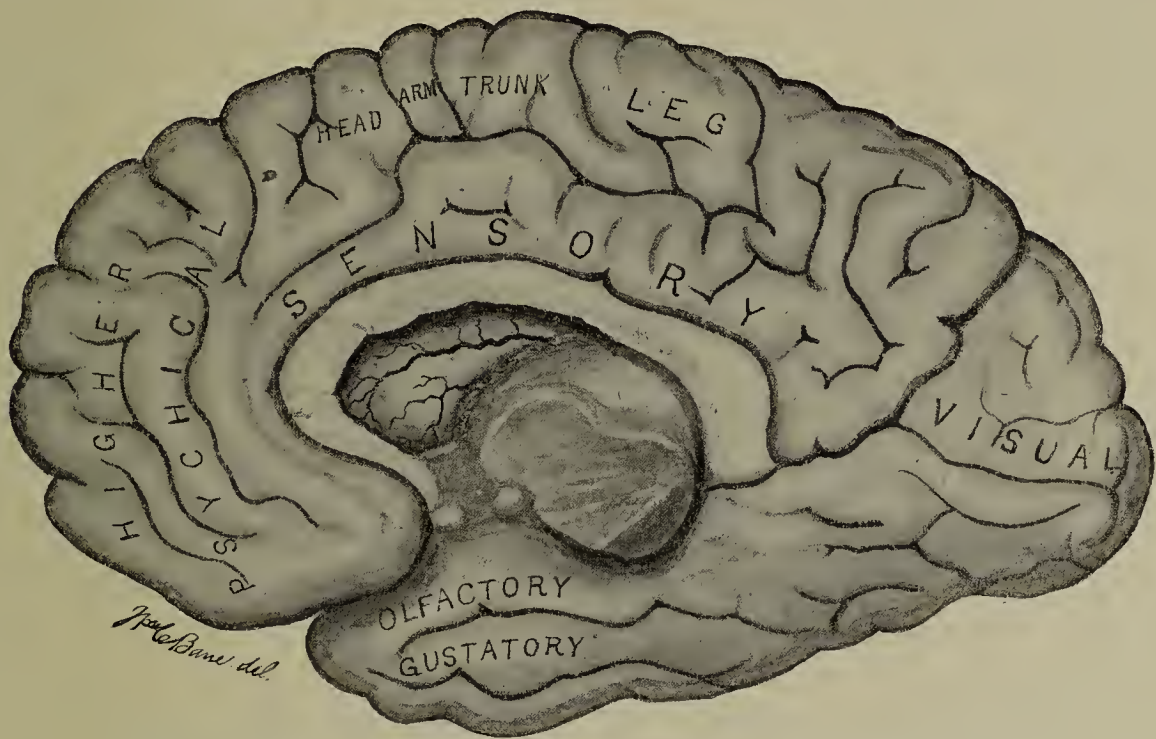
TUMORS OF THE PARIETAL REGION may or may not give rise to localizing symptoms, depending upon their size and the involvement of certain structures. It is thought by some that muscular sense is affected by a lesion in the supramarginal convolution. On the left side, in right-handed persons, or on the right side



in left-handed ones, a growth affecting the angular gyrus or inferior parietal lobule produces word-blindness. If the optic radiations are encroached upon by the tumor, lateral homonymous hemianopsia will be present.

TUMORS OF THE OCCIPITAL LOBE affecting the cuneus or optic radiations will cause lateral homonymous hemianopsia, the blind fields being on the side opposite to that of the lesion. Mind-blindness has been observed in connection with growths in the left occipital lobe, especially near its anterior portion.

pressure, and, later, hemiparesis, or bilateral weakness, with rigidity of the muscles of the trunk and legs, and often ataxia of the cerebellar type. The disturbances are usually more marked on one side than on the other, and the legs are affected to a greater degree than the arms. Tumors of this region with ataxia are distinguished from those of the corpora quadrigemina by the absence of oculomotor symptoms until late in the disease, and from growths in the cerebellum from the cranial nerves of the bulb escaping.



Median aspect of the right hemisphere, showing cortical centres.

TUMORS OF THE TEMPORO-SPHENOIDAL LOBE may give rise to no focal symptoms, when they are situated on the right side. On the left side word-deafness will result if the posterior portions of the first and second convolutions are affected. When the anterior portion of the lobe is involved near the base on either side, disturbances in smell and taste may be present.

TUMORS OF THE CORPUS CALLOSUM may cause general symptoms of intracranial

TUMORS OF THE GREAT GANGLIA give rise to no focal symptoms until the internal capsule is affected either directly or indirectly. Complete hemianæsthesia from tumor in the basal ganglia practically does not occur without motor defect. When the hemianæsthesia is complete, all the special senses may be lessened or lost on the anæsthetic side, the visual defect being lateral homonymous hemianopsia, with the blind fields on the side corresponding to the affected side

of the body. Athetoid movements and marked inco-ordination, chiefly affecting the hand, have been observed in lesions of the thalamus. A tremor similar in character to that of multiple sclerosis has occurred from tumor in this region, but it is always unilateral.

TUMORS OF THE CORPORA QUADRIGEMINA, besides the general symptoms, such as headache, double choked disk, and vomiting, cause ataxia and incomplete ophthalmoplegia. The ataxia is similar to that observed in lesions of the middle lobe of the cerebellum. Bruns states that the ophthalmoplegia will precede the ataxia when the lesion is in the corpora quadrigemina, but the ataxia will precede the former when the tumor is in the cerebellum.

TUMORS OF THE CRUS produce "crossed paralysis," hemiplegia on the opposite side of the body,—including the limbs and lower side of the face,—and paralysis of the third nerve on the side on which the tumor is located. Hemianæsthesia will be present on the hemiplegic side if the fibres on the upper or posterior portion of the crus are involved. If the optic tract is seriously affected, lateral homonymous hemianopsia will be present, and the pupils will not react to light thrown into the eyes from the side of the blind fields: the hemiopic pupillary reflex of Wernicke.

TUMORS OF THE PONS give rise to distinct, but variable, symptoms, depending upon the size and exact location of the growth. A tumor may be situated to one side of the pons and cause decided pontile symptoms from direct pressure, and if the pons is pushed to one side, against the bony structure, as not infrequently happens, the indirect-pressure symptoms on the opposite side of the pons from the seat of the tumor may be very pronounced. If the tumor is situ-

ated in the upper portion of the pons, on one side there will be "crossed paralysis," and possibly hemianæsthesia, as in tumor of the crus. During the irritative stage of the sixth nerve, the eyes may be spasmodically jerked toward the side of the lesion, but when this nerve is paralyzed conjugate deviation of the eyes will be to the opposite side. The symptoms from a tumor in the upper portion of the pons on one side, if from diffusion of irritation the sensory tract on the opposite side is not affected, would be conjugate deviation of the eyes to the opposite side, weakness or paralysis, and disturbances of sensation throughout the entire opposite side of body, head, and face. Owing, however, to the diffuse character of the symptoms, both direct and indirect from tumor of the upper portion of the pons, the symptoms are more likely to be dilatation of the pupils, ptosis; strabismus, at times; sometimes cloudiness and ulceration of the cornea; pain, with hyperæsthesia and anæsthesia in the region of the distribution of the fifth nerve on side corresponding to that of the tumor; and hemiplegia and hemianæsthesia of the opposite side of the body and face, the latter if the lesion extends deep in the substance of the pons, often in the form of dissociation of sensory symptoms (loss of pain and temperature sensations; tactile preserved) and loss of conjugate movement of the eyes toward the side of the lesion. Other cranial nerves would probably be affected as the disease progressed. A tumor situated in the lower half of the pons on one side would give rise to crossed motor and sensory paralysis; the face, both the lower and upper on the side of the lesion; the body and limbs on the opposite side. Marked trophic disturbances usually occur through the distribution of the affected fifth cranial nerve. Articulation,



deglutition, and respiration become affected in lesions of the extreme lower portion of the pons from the involvement of other cranial nerves. As a rule, these are late symptoms in the course of the disease. Tumors lying between the pons and dura often cause bilateral symptoms on account of the cord being pushed against the bony structure. They differ from those caused by tumors within the pons in being more irritative and less destructive in character until late in the course of these growths, and cranial-nerve symptoms precede those of the pons.

Glycosuria and albuminuria may occur, giddiness is often intense, and vomiting troublesome if the middle peduncle of the pons is involved. The tumor may directly affect both sides of the pons and produce bilateral symptoms. The kneejerks are as frequently absent as present, and are extremely variable: present and exaggerated at one time, normal or absent at another.

TUMORS OF THE MEDULLA at first may give rise to unilateral symptoms, but these soon become bilateral, and are somewhat similar to those of progressive bulbar paralysis, except that sensory as well as motor fibres are affected in the former. It must not be forgotten that an intradural tumor of the medulla gives rise to bilateral symptoms on account of the displacement of the medulla to one side against the foramen magnum.

TUMORS OF THE CEREBELLUM cause well-marked general symptoms, such as headache, double choked disks, vomiting, and often dizziness. Focal symptoms, however, will be entirely wanting if the tumor is not very large and situated in one hemisphere, especially in its posterior portion, so as not to affect the functions of the middle lobe or those of the pons. The most reliable and constant

symptoms of a growth affecting the middle lobe are the disturbed muscular movements, the cranial-nerve symptoms, and the subjective sensations of insecurity, both while standing and lying. The inco-ordination of muscular movements is most pronounced in the legs, next in the trunk, and least in the arms. The patient's gait is similar to that of a drunken person, the feet well separated laterally in standing and walking, and the body is often thrown to one side, forward, or backward by forced muscular movements. There is no paralysis of legs or arms, unless the fibres in the pyramidal tracts are affected, and no anæsthesia. The patient has a sense of insecurity of his position, especially while standing, and this is sometimes complained of when he is lying in bed. If the tumor is situated well forward and in the median portion of the middle lobe, the cranial-nerve symptoms will be bilateral; if to one side they will either be unilateral or, at least, most marked on the side corresponding to the tumor. The facial, auditory, and sixth nerves are most commonly affected. The ophthalmoplegic symptoms observed in tumors of the cerebellum affecting the superior peduncles appear secondary to the inco-ordination; when they are due to a tumor in the corpora quadrigemina they precede the ataxia.

TUMORS OF THE BASE strictly limited to the anterior fossa would affect the olfactory nerves, but by extending backward into the middle fossa they may cause unilateral loss of sight or some form of hemianopsia. Mental symptoms are usually present on account of pressure on the anterior lobes. A tumor in the middle fossa, if situated near the sphenoidal fissure, may paralyze all the motor nerves to one eye and compress the first division of the fifth, causing uni-

lateral ophthalmoplegia, anæsthesia, and pain in the region of distribution of this division of the trigeminal nerve, together with trophic changes in the eye. The Gasserian ganglion and all the divisions of the fifth nerve—as well the second, third, fourth, and sixth nerves—are exposed to the invasion of tumors in the middle fossa. Tumors of the posterior fossa injure the cranial nerves, pons, and medulla, and give rise to many of the symptoms of tumor of the pons and medulla, with these differences: that tumors in this fossa affect the nerves before they do the pons or medulla; in paralysis of the sixth nerve from injury to its trunk the conjugate fibres of the internal rectus of the other eye are not affected, as in nuclear paralysis of this nerve; and the seventh and eighth nerves are usually involved by the same lesion, as they all lie near together at the base.

**Multiple Tumors.**—According to Dana, about one-seventh of all brain-tumors are multiple. The tubercular, cancerous, and melanotic varieties are most commonly multiple. I have found seven tubercular nodules of considerable size in one brain, situated in widely different portions of the brain.

In only a comparatively small number of cases is it possible to determine the exact nature of the growth, and often the conclusion at which one arrives is little more than a shrewd guess. Secondary growths in the brain usually are of the same nature as the primary one in other portions of the body. Evidences of syphilis or tuberculosis in a person suffering from tumor of the brain points to the probable nature of the growth. Inherited syphilis very rarely gives rise to tumor of the brain. The most common cerebral growths in children are the tubercular, and these may occur in childhood without the signs of tuberculosis

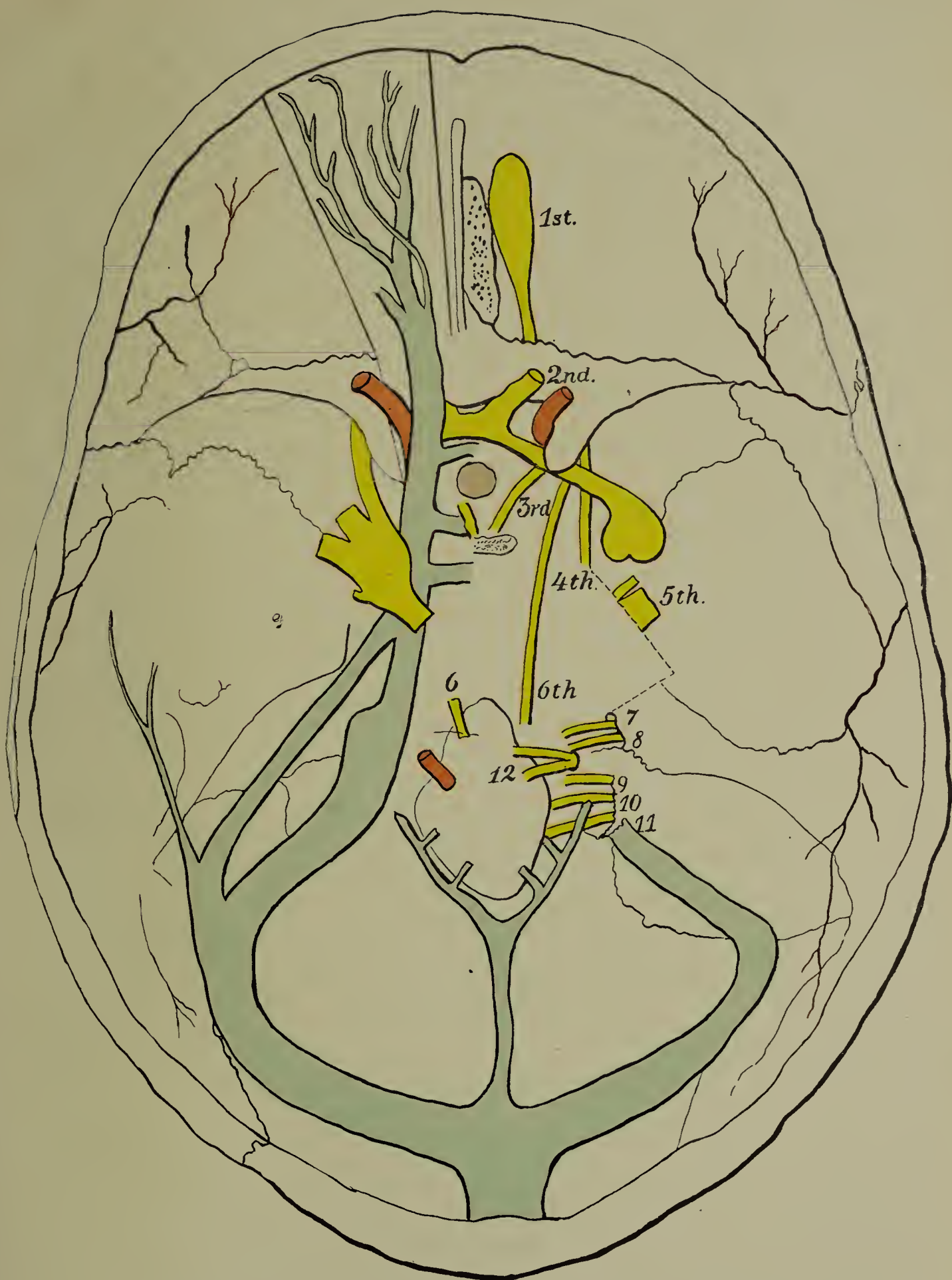
in other portions of the body. The cerebellum, comparatively speaking, is remarkably exempt from syphilitic tumors, but the tubercular and the gliomatous are the most frequent here. Growths in the cortex are usually syphilitic, tubercular, or sarcomatous. Gliomata and sarcomata frequently occur in the centrum ovale, and may subsequently involve the cortex. The symptoms of most growths of the brain are at first favorably modified by active antisymphilitic treatment. If the improvement is very great and can be maintained by such treatment, it is strong evidence in favor of the syphilitic nature of the growth.

**Etiology.**—**PREDISPOSING CAUSES.**—Cerebral growths may occur at any time of life. The third decade furnishes the largest number, about 20 per cent.; the first and fourth about 18.5 per cent. each; and the second and fifth about 14 per cent. each. They are rare in extreme old age. Steffen has reported a case of tumor of the brain in an infant four weeks old.

The character of the tumor varies considerably with the different periods of life. Tubercular, cystic, gliomatous, and sarcomatous varieties are frequent in childhood and early adult life. The tubercular largely predominating in childhood. Syphilitic growths are most common in young and middle-aged adults. The gliomatous, sarcomatous, and gliosarcomatous are most frequent during the latter period. In my experience I have found cystic growths much more frequent in adults than in childhood, although this is contrary to the results obtained from a study of tabular statistics. Carcinomatous growths are found most commonly during the degenerative period of life.

**Sex.**—After the age of fifty tumor of the brain is found with about equal frequency in the two sexes, but before this





Base of skull, showing the different fossæ, with nerves and sinuses.





time, not excluding early childhood, the male sex suffers nearly twice as often as the female. It seems, then, that the explanation for the increased liability of the male sex to suffer from tumor of the brain must be sought in conditions pertaining to the developmental and active periods of sexual life.

*Heredity.*—It is still doubtful whether hereditary influences, excluding the tubercular and the carcinomatous, play any part in the causation of tumors of the brain.

It is probable that worry, anxiety, excessive alcoholic indulgence, cerebral congestion, and depressed states of the nervous system favor the development of cerebral growths in tubercular and syphilitic subjects, and they favor the formation of cancerous growths in other portions of the body and secondarily in the brain in certain persons, especially those who are the offspring of families in which the history of cancer is found.

**EXCITING CAUSES.**—There is apparently a direct relation between injury of the brain and the development of tumor in only a few instances. It appears from the study of numerous cases that this relation is frequently overestimated.

Syphilis and tuberculosis are two of the most potent causes of tumors of the brain. I have no doubt that the time will come when we shall be able to attribute the origin of many tumors of the brain to micro-organisms.

**Pathology.**—According to Gowers, about four-fifths of the non-syphilitic tumors of the brain are either tubercular or sarcomatous (including the gliomatous). It is difficult to determine the frequency of syphilitic tumors of the brain, as so many cases yield temporarily or permanently to antisymphilitic treatment, and are lost sight of by the observer. The dif-

ficulty is still further enhanced from the fact that many cases of non-syphilitic tumors temporarily yield to antisymphilitic treatment, and may pass from under the physician's observations before their true nature is determined. The gliomata are found only in the central nervous system and in the retina, and occur far more frequently in the brain than in the cord.

From a study of Starr's tables, consisting of analysis of three hundred cases of tumor of the brain in children, in nearly one-half the tumor was found in the cerebellum, pons, and medulla, while in the same number in the adult only a little more than one-fifth were located in this portion of the brain and its stem. The cerebellum in childhood appears to be a little more than twice as often the seat of tumor as in adult life, but in adults the cortex of the cerebrum is the seat of tumors six times as often as in childhood. From a study of the location of tumors it will be found that portions of the brain inaccessible to the surgeon's knife are much more commonly the seat of growths in children than in adults.

Tubercular growths are the most frequent of brain-tumors, especially in childhood, and their most common seat is in the cerebellum or other structures in the posterior cerebral fossa. In nearly one-half the cases the growths are multiple, and give rise to a confusion of symptoms, especially in relation to localization. Syphilitic growths, which are often accompanied by endarteritis or a low form of meningitis, affect the cerebrum much more frequently than the cerebellum, and are found on the surface, either at the base or on the convex surfaces of the frontal lobe and the convolutions near the fissure of Rolando. Gliomata and sarcomata are frequent forms of tumor of the brain. The former

grow from the neuroglial tissue, infiltrate the surrounding portions of the brain, may be of considerable size, and are often scarcely distinguishable from the adjacent brain-substance; the latter develop from the connective tissue of the membranes and vessels, and are frequently capsulated.

**Prognosis.** — The tubercular in children and the gummatous growths in young adults give the most favorable prognosis. In rare instances a sarcomatous growth may become capsulated and cease to grow or even decrease in size. The duration of life in tumors of the brain varies from a few months to two or three years. In exceptional cases life is prolonged for many years.

**Treatment.** — Persons suffering from tubercular or syphilitic growths should be kept as well nourished as possible, by means of a generous and nutritious diet, and general tonics, consisting of codliver-oil, iron, quinine, extract of sumbul, and arsenic, together with plenty of fresh air. In tubercular tumors alcoholic stimulation in many instances has seemed to be beneficial in my experience. The treatment should be different in the early stages of intracranial growths from that which should be adopted after the brain has received considerable damage and the tumor attained considerable size. In the early course of the disease the patient should have the benefit of the doubt when syphilis cannot be excluded. The more acute and irritative the symptoms in cases of syphilis of the brain, the greater the demand for mercury pushed rapidly to its constitutional effect; the slower the growth, the more likely that potassium iodide will be more beneficial than mercury. In most cases, while inunctions of mercury are employed vigorously, potassium iodide should be pushed to the point of tolerance. If

with six weeks' active antisyphilitic treatment, carried to the point of tolerance, the symptoms do not begin to yield, it is probable that little will be accomplished by this method. It should be borne in mind that syphilitic subjects, who are emaciated and anæmic, will not respond to active antisyphilitic agents until the nutrition has been improved. In the late stages of tumor of the brain prolonged and vigorous antisyphilitic agents are, to say the least, useless, if not cruel. In such cases, if improvement is not manifest within one or two weeks, vigorous measures should cease.

Headache is lessened by keeping the bowels open freely each day, the digestive organs in the best possible condition, and avoiding causes that are likely to increase the blood-supply to the brain. Cold to the head and a mustard plaster to the nape of the neck often relieve an annoying headache. Sometimes local abstraction of blood from the head by means of leeches to the temple or nape of the neck has been employed with benefit.

Such anodynes as cannabis Indica (Hering's extract or Parke, Davis & Co.'s normal liquid), with one of the coal-tar products, with or without codeine, should be employed before hypodermic injections of morphine are resorted to. Mustard to the neck and over the stomach, with cold to the head, will often relieve vomiting. Twenty to 30 grains of hydrate of chloral given by bowel in starch-water will often stop the vomiting as well as the general convulsions. Morphine hypodermically administered may be resorted to with confidence in the intractable cases of vomiting and general convulsions.

In case the tumor is accessible to the surgeon's knife, an operation for its removal should not be postponed if the



symptoms have failed to be decidedly modified by antisyphilitic agents, vigorously pursued for a period of from six to eight weeks. No one should think of trying to remove a carcinoma or a melanotic sarcoma from the most accessible regions of the brain, if the diagnosis of the nature of the tumor were possible or strongly probable. In some cases of tumor of the brain, in which there is no prospect of removing the growth, in the hopes of relieving the severe and agonizing pain a button of bone may be removed from over the seat of pain. In two personal cases this procedure has lessened or relieved the pain for prolonged periods. Several other similar cases, equally successful, have been reported.

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### TUMORS OF THE BREAST.

**Benign Tumors.**—Benign tumors of the breast include *hypertrophy*, *adenoma*, *fibroma*, *cysts*, *osteoma*, and *tuberculous tumors*, besides *galactocoele*, which has been described under MAMMARY GLAND, DISEASES OF.

**Hypertrophy.**—Hypertrophy of the mammary gland is usually met with between the twentieth and the thirtieth year. Its onset is quite insidious: the breasts begin to swell and steadily increase in size within a few months, until they have attained quite noticeable proportions. The enlargement may effect both organs, but sometimes only one of them. The breast keeps the shape of a hemisphere, but it is much firmer than usual. When, however, it has become very large, its weight causes it to fall below the abdomen, the upper portion forming a more or less large cutaneous pedicle. It sometimes assumes very great proportions.

The menstruation, as a rule, is dis-

turbed. Pains appear which, though rare at first, become more and more pronounced. The patient, however, complains especially of extreme fatigue caused by the enormous weight. In some cases the breasts acquire almost incredible proportions; the patient loses her appetite, and occasionally dies of weakness and prostration, the autopsy showing no other alteration than the enlargement.

**TREATMENT.**—Iodide of potassium used early and in large doses and moderate pressure exerted by means of a flannel or rubber bandage sometimes retard or arrest the growth. If the tumor continues to grow, operative measures must be resorted to. Lactation seems to cause diminution, and has been followed by a cure in a few instances.

**Adenofibroma.**—Adenofibroma is frequently observed, and may appear at any age, but is usually met with between the ages of fifteen and forty-five years: during the sexual life. Menstrual disturbances and contusions of the breast are thought to exert a certain pathogenic influence.

**SYMPTOMS.**—Adenofibroma grows insidiously, but pain is only present in exceptional cases, and is usually increased during the menstrual period. The growth rolls under the fingers, and its surface is generally irregular, though the skin is unchanged and elastic under pressure. The nipple is not retracted, but there occasionally exudes from it a sero-sanguineous fluid.

The subcutaneous veins are only slightly, if at all, dilated, except when the tumor is very large. The axillary glands are usually normal, and the patient's general health is good. Very rarely these growths have been known to attain a considerable size in a short time, and the distended skin to become

thinned and ulcerated. But the cutaneous tissues remain free and loose, and the ulcerative process presents none of the characteristics of cancerous ulcerations.

**TREATMENT.**—The progress of small adenomata may be retarded by the local use of iodine and by slight compression, but, if they continue to increase in size, they should be excised. It is important to remember that the excision should be complete, the least remnant becoming, otherwise, a focus of recurrence.

Adenomata are not the harmless growths that many believe them to be, as there is a great probability that they may and do become cancerous. Medicinal therapeutics, external and internal, are useless. Early recourse to the knife affords a safe and satisfactory method of dealing with them. Balloch (*Amer. Jour. of Obstet.*, Oct., '98).

**Galactoceles, or Lacteal Tumors.** (See **MAMMARY GLAND**, volume iv.)

**Cysts.**—These growths are occasionally met with, and present only as symptom a localized enlargement, with unmistakable fluctuation.

Cysts are usually due to dilatation of the glandular portion of the lacteal tubes, followed by obliteration of the excretory duct; occasionally the sac develops in the interstices of the gland. In the tubular form a clear or gelatinous serum is exuded; the parenchymatous cysts, however, usually contain a sanguineous fluid. The cystic walls form part of the surrounding tissues, and cannot be peeled off from them without lacerating the latter.

A peculiar type of cystic disease of the breast has been described by Réclus. It consists in the development in the healthy tissue, and in both breasts at once, of a large number of cysts varying greatly in size from that of a pin's head to a hen's egg, and containing a more or less thick liquid, which may be either

quite transparent or dark. Their growth is gradual and cause but little, if any, suffering. They feel as hard subcutaneous masses which cannot be said to fluctuate. Réclus suggests their kinship to epithelioma and the theoretical possibility of their assuming a malignant type.

Clinical experience has sustained this view in some instances. As a rule, however, a pure cyst, when left to itself, remains benign, and, when operated upon under strict antiseptic precautions, does not recur.

**TREATMENT.**—A serous cyst should be aspirated with a small trocar, this being followed by the injection of iodine. If suppuration occur, or if the cyst is not cured by the injection, it should be opened and evacuated. Excision may have to be resorted to, but the fact that the walls of the cyst are not free from the adjoining tissues renders this procedure somewhat difficult.

During the past fourteen years 39 cases of retention-cysts of the breast have been noted. The majority of cases were in married women who had had children; in only 4 was there a history of mastitis, or sore nipples. The diagnosis of retention-cysts of the breast is easy when the cysts are superficially situated or in small soft breasts; they are smooth and rounded in outline and offer elastic resistance; the skin is never adherent, the nipple is normal, and they are usually painful, while small cancerous deposits are not usually painful. Puncture with an hypodermic needle is the final diagnostic test.

The treatment should be begun with aspiration, and incision should be undertaken only in case the cysts refill or are unusually large, or in case the patient is exceptionally nervous and is tormented with the idea of the development of carcinoma. Patients with general cystic diseases are advised to wait, as sometimes the condition remains without change; advanced cystic disease calls for excision of the breast. There is little evidence that this condition de-



generates into carcinoma; if so, it is very slow in development. William T. Bull (Med. Record, Apr. 22, '99).

Analysis of 142 cases of breast disease, 67 of which were cystic. Of these, 23 were in single and 44 in married women, one-half of the cases occurring between the ages of 40 and 50. Conclusions: Simple cysts of the breast are far more common than they are generally believed to be. They are chiefly found at the same period of life at which cancer is met with, and are mostly quite amenable to local treatment without sacrifice of the breast-gland. Exploratory incision is indicated in all cases. If the cyst-wall is found free from papillary growth, all that is necessary is to swab it out with tincture of iodine. Any intracystic growth, however small, warrants removal of the cyst. When the growth is flesh-like, either the lobe involved or the whole mamma should be removed, as the case may be. T. Bryant (Lancet, Apr. 28, 1900).

**Miscellaneous Growths.**—Among the growths rarely met with are **OSTEOMA** and **LIPOMA**. The former especially are very rare. **CALCULI** have occasionally been found in galactoceles, and cysts have been met with whose walls have become calcareous. Cases in which the entire breasts have hardened sufficiently to simulate stone when touched have also been recorded.

### **Semimalignant and Malignant Tumors.**

**Sarcoma.**—Pure sarcoma is rarely met with; it is usually associated with other morbid conditions of the mammary tissues; hence the names *adenosarcoma*, *fibrosarcoma*, *myxosarcoma*, *cystosarcoma*, given these growths and which denote their associations.

**SYMPTOMS.**—Clinically sarcoma may assume the type of a rather *circumscribed* tumor, which is immovable, lobulated, and firm. After a time the elevations project somewhat, and may become very soft, and finally become foci of ulcera-

tion. The semimalignant nature of the growth then appears and the axillary glands may become enlarged.

A second form is the *diffuse* sarcoma, which rapidly invades the entire gland, but follows otherwise about the same clinical course of the first variety. In sarcomas associated with soft tumors, such as adenoma or myxoma, the tumor is less hard, and suggests the benign forms with which the sarcomatous type is combined.

**DIAGNOSIS.**—From cancer of the breast sarcoma is distinguishable by the following characteristics: It does not adhere to the skin, though this may be distended, thin, and even ulcerated, owing to the size of the tumor. The entire gland is not, as a rule, affected and the nipple is not retracted. The axillary lymphatics are seldom enlarged. There is but little pain. Again, sarcoma occurs in young adults, whereas cancer rarely appears before the age of forty-five years. It is frequently observed in men and is usually in them of traumatic origin. They are often mistaken for abscess and opened.

**PROGNOSIS AND TREATMENT.**—Sarcoma is ranked next to cancer as regards malignancy. It may also recur after extirpation, and may become generalized in the viscera. The fact that it does not always do so causes this variety of growth to be classed as semimalignant. It should be removed, including the superjacent skin. This is easily accomplished by raising the mass with one hand and including it within two semilunar incisions, the tips of which meet. No diseased tissue should be allowed to remain.

**Cancer of the Breast.**—Out of 750 cases of mammary diseases of all kinds witnessed in St. George's Hospital, London, by Marmaduke Sheild (Brit. Med.

Jour., May 3, '96) about one-half—353—were carcinomatous.

The predisposing and exciting causes of cancer in this location are almost invariably explainable through a reduction of the powers of resistance of the mammary tissues, brought on through trophic disorders. These, in turn, may be due to induration following the various forms of mammitis (see MAMMARY GLAND), abscesses, Paget's disease, especially; and of disorders of the nipple: abscess, psoriasis, eczema, etc. Traumatism is a fruitful exciting cause when the breast has been weakened by disease; old age enhances the chances of a local morbid development by decreasing the local powers of resistance.

**Varieties.**—Two forms of cancer of the breast are met with, the *scirrhus*, or hard, cancer, in which there is excessive development of fibrous tissue, and the *encephaloid*, or soft, cancer, in which the epithelial elements play the leading rôle. (See TUMORS, this volume).

**Scirrhus, or Hard, Carcinoma.**—In this variety the initial symptoms vary with the location of the primary cancerous focus. In deep-seated cancer the gland may become enlarged and hard, but not essentially deformed. The skin adheres closely to the mammary tissues, and the gland itself adheres to the mammary walls. In other cases the breast practically collapses and atrophies and the nipple becomes retracted, constituting the atrophic, or withering, form of scirrhosis. In still another type the cancerous process affects a certain part of the breast only, and thence invades the whole gland by throwing out fibrous bands or strips, which radiate through the organ in all directions. The surface of the breast may then assume various types of irregularity, with promiscuously distributed undulations.

The tumor may be essentially cutaneous at first and subsequently invade the deeper tissues. It then appears in the form of irregularly disseminated *plaques* or hard, superficial areas, which unite and may involve a large portion of the superficial tissue. The skin appears as though tanned; and is hard, rough, thick, and red. This scirrhus transformation may gradually affect the whole anterior portion of the thorax, which thus appears to be covered with sole-leather-like covering; hence the name "*en cuirasse*" given this type of cancer. Sometimes the disease appears in the form of nodules varying in size from that of a cherry to a millet-seed. These nodules are hard and vary greatly in number. They may, however, remain in the same condition a long time if let alone, but frequently ulcerate. If removed they rapidly recur. They are due to penetration of the cancer-cells into the perivascular lymph-spaces of the cutaneous vessels. When scirrhosis of the skin follows upon a deep-seated cancer, similar nodules may develop around the edge of the cancerous ulcer. Their appearance indicates a tendency to spread and to become generalized.

Scirrhus, or hard, cancer, when left to itself, transforms the whole breast affected into a stone-like mass. Into this the nipple is more or less drawn by contraction of the milk-ducts through infiltration of the latter with young cells and subsequent metamorphosis into fibrous tissue. If the cancerous focus is far from the nipple, the latter may only be somewhat distorted through irregular tension of the skin.

Deep or superficial ulceration may occur, which differs greatly from that observed in the epithelioma of the breast. The ulcer resembles a crater with irregular, hard, everted edges, and whose



base is covered with foul, unhealthy granulations, giving off a thin, offensive discharge. Such ulcers are apt to bleed, and severe hæmorrhages may occur. The axillary glands become involved early; but their detection at first requires careful examination. They gradually enlarge, and by pressing upon the surrounding vessels and nerves may give rise to œdema of the arm or to neuralgic pains. The entire lymphatic system of the trunk is exposed to contamination; hence the visceral complications often witnessed.

Suffering only becomes serious when the tumor has reached a certain size. Pain of a stinging or burning character is sometimes complained of; involvement of nerves often cause it to be neuralgic and persistent, especially in the shoulder and arm. The ulcerative process, the general toxæmia incident upon the presence, the purulent mass, and the mental sufferings of the patient bring on exhaustion which finally end in death.

**Encephaloid, or Soft, Carcinoma.**—The encephaloid variety of mammary cancer, though less frequently met with than scirrhus, is nevertheless common. It always starts in the gland itself, and only affects the skin at a later period. Its onset is insidious. It may have existed for some time unperceived by the patient. A hard tumor located in the gland is first noticed; this may be free from surrounding or fixed, according to the time it is detected. It may also present nodules varying in density, owing to the presence of cysts and sanguineous infiltration. At first the skin is free and traversed by unusually-prominent bluish veins, some of which finally become varicose; spots of redness then appear, the precursors of adhesion to the skin of the cancerous mass. This occurs at an early stage, and is caused by infiltration of the

cancerous elements into the tissues. The whole tumor then becomes a reddish, fluctuating mass which soon degenerates and becomes fungous; it then bleeds easily when touched, and gives off a foul odor. Burning and shooting pains, which are more severe and appear earlier than in scirrhus cancer, occur, and steadily increase in intensity. Retraction of the nipple also occurs, and engorgement of the lymphatics can be detected at an earlier date.

The ulceration differs essentially from that of scirrhus. Instead of being surrounded with a harder border, forming a crater-like cavity, it assumes the aspect of a large fungous sore. The least touch causes it to bleed, and hæmorrhages are much more frequently observed than in scirrhus, but fortunately are arrested with less trouble. Cachexia also appears earlier. All the acute symptoms are aggravated, and complications in remote organs are more frequently observed.

**Diagnosis.**—The anxiety caused by a growth in this region renders a careful differential diagnosis of unusual importance.

The first question to be determined is whether the tumor be benign or malignant. To determine the exact nature of a tumor at the very onset is often impossible, but this difficulty gradually decreases as time progresses. Still, there are at all times landmarks upon which the surgeon may base a guarded opinion even early.

As a rule, benign tumors occur before the age of thirty-five or forty, while the malignant growths are seldom met with before that age. Again, the evolution of the neoplasm is much more rapid in malignant tumors than in the benign. These usually remain free or detached, and, if at all superficial, can be rolled under the finger, indicating the absence

of adhesions. In malignant tumors, on the contrary, adhesion to all the surrounding tissues becomes at once evident, their limits, even in the beginning, being practically indefinable, while later on the cutaneous and all the underlying tissues become incorporated in the tumor.

The density of the growth and the aspect of the skin also afford a clue. Benign growths are usually soft and elastic when pressed upon, while malignant neoplasms are hard and lumpy. The skin retains its softness and usually rides freely over the benign tumor, while over a malignant one the skin becomes abnormal and assumes a leathery aspect.

In benign growths the nipple usually remains free or merely distorted by the change in shape of the breast. In cancer it is drawn into the organ and held fast in that position by fibrous bands.

An oozing of blood from the nipple of a breast in which no appreciable change can be seen is a serious symptom: a precursor of the development of cancer. The discharge may precede the appearance of tumor several years. Delbet (Bull. Méd., Dec. 4, '95).

Examination of 80 tumors of the breast were found to be medullary carcinoma, 21 carcinoma simplex, .5 colloid carcinoma, 10 scirrhus, 9 adenocarcinoma, 18 fibroma, and 6 sarcoma. It seems justifiable to conclude from the examination that there is no strictly benign tumor of the breast, and that the only rational treatment is complete removal as soon as discovered. Hyde (Jour. Amer. Med. Assoc., Mar. 31, 1900).

Examination of 37 cases of primary tumor of the mamma. Ten of these were tumors of the areola, 27 of the papilla. Conclusion that only the myomas and pedunculated tumors can be considered as absolutely benign, and that other varieties are already malignant or will become so sooner or later. A. O. Lindfors (Monats. f. Geburts. u. Gynäk., Apr., 1900).

The lymphatic glands of the axilla rarely, if ever, become enlarged in benign growths; if they do at all, the enlargement is slight. In malignant growths they are always more or less enlarged, and steadily increase in size as the disease progresses.

Benign tumors very seldom cause inconvenience to the patient except by their volume and their weight. Malignant tumors, on the other hand, are attended by more or less pain, usually of a lancinating character. The suffering becomes more acute from day to day.

Ulceration sometimes occurs in benign tumor through pressure, but only when the growth is very large. The edges of the ulcerated portion remain thin and free, and there is no foetid or sanious discharge. In cancer, as stated, ulceration is one of the salient features and is characterized by marked foulness. The general health usually remains good in benign tumors. In malignant tumors the patient soon becomes cachectic and shows marked evidence of deterioration. The oedema of the arms and the complications alone belong to the malignant types of growth.

**Treatment.**—Internal remedies innumerable have been proposed as specifics, but time has in all demonstrated their worthlessness in *bona fide* cases of cancer. Even the local methods, topically or hypodermically employed, and which will be described at the end of this article, are open, if effective, to serious objections, and should, therefore, only be resorted to in inoperable cases or when the patient, through fear or for other reasons, will not allow the use of the knife. The surgeon must, therefore, choose between the palliative method, which resolves itself into reducing the patient's sufferings during her gradual progress toward death, and the radical



method, which gives her, if the tumor is not too far advanced, a good chance to recover. Especially is this the case since greater freedom has become the rule in the removal, not only of cancer of the breast, but of the contaminated glands. Indeed, nowadays few operations for well-developed cancer can be considered radical unless removal of the primary growth is accompanied by prophylactic extirpation of its tributary lymphatic areas.

The experience of the last two decades, and more especially of the last ten years, has shown, according to statistics, collected by Rudolph Matas (Phila. Med. Jour., Sept. 17, '98), by more thorough operating, the chances of recurrence are greatly diminished. While the results of the *older* operations give the following percentages of local recurrences: Billroth, 85; Czerny, 62; Fischer, 75; Gussenbauer, 64; Volkmann, 59; and Gross, 68; the *later* operations show much better results: Halsted, 22; Watson Cheyne, 18; Rötter, 14; and Dennis, only 5 per cent. of local recurrences within a period of three years. Joerss's estimate (1897) based upon a study of 76 cases operated upon by four surgeons (Heidenhain, Rötter, Helferich, and Watson Cheyne) gives 30.3 per cent. of local recurrences within three years.

Far more important is the actual number of cures obtained by present methods. Here again the statistical evidence is encouraging. Billroth (1876) claimed 4.7 per cent. of cures; Küster (1881) 21 per cent.; Koenig, 23; and Bergmann, 39; while the average of Rötter, Helferich, and Watson Cheyne's cases (1896) was 49.5 per cent. Watson Cheyne found that, while in a collection of 1491 cases, obtained from various sources and operated upon by older methods, 14 per cent. had been cured, 111 operated by

newer methods had yielded 34 per cent. of cures.

Of 260 patients suffering from mammary carcinoma in the years 1890-99, inclusive, 27 per cent. were found to be inoperable, 2 died as a result of operation, 56.6 per cent. died of recurrence, 6 per cent. were living with recurrence, and 16.9 per cent. were definitely cured. Editorial (Therap. Gaz., June, 1901).

Unfortunately many cases are not seen sufficiently early to warrant operative procedures. Glandular involvement has often been allowed to extend to the axillæ, when the chances of a successful issue are reduced. These become inoperable cases, however, when scattered cancerous tubercles are met with over large areas, indicating extensive infiltration of the skin,—i.e., undefined limits; or, when the cancer *en cuirasse* type has been assumed, and has so progressed as to involve a large part of the surface. They become especially so when the internal viscera—the liver, the lungs, etc.—show indications of metastasis. Great and persistent œdema of the arm is considered as a contra-indication, but it should not stand as such in all cases.

Statistics of operation for cancer of the breast in Scandinavian countries:—

Mortality of the operation itself, 2.28 per cent.

Death from relapse, 56.38 per cent.

Reoperated, 9.34 per cent.

Death without relapse, 3.30 per cent.

No relapse, 28.70 per cent.

A much more radical operation than usually performed recommended as to the removal of the skin, fatty and connective tissue, muscles, and glands. Dahlgren (Nor. Surg. Congress; Phila. Med. Jour., Sept. 9, '99).

Reports of cases in Lennander's service in which the supraclavicular fossa is only opened when the glands are felt to be enlarged. Out of 74 operations, 60 have been done more than three years, and 1 died from the operation. Out of the remaining 59, 26 are well and living; 24 have died from external recurrences; 9

are dead from accidental or unknown causes or from internal recurrences. Recurrences may take place at a very late date—four, five, or even seven years after operation. Dahlgren (*Quarterly Med. Jour.*, vol. viii, Part IV, 1900).

The following summary is the result of a study of 100 cases of cancer of the breast: Trauma present in 44.6 per cent. of the cases. Married, 74 per cent. of the cases. Children born to 66.6 per cent. of the cases. Average number of children to each, 5. Pain present in 56.2 per cent. of the cases. Nipple retracted in 45.2 per cent. of the cases. Right breast involved in 51 cases. Left breast involved in 49 cases. Axillary glands palpable in 48.9 per cent. of the cases. Axillary glands found cancerous by microscope, 78.6 per cent. of the cases. Average age was 49 years, 6 months, and 26 days. Mortality of operation was 4 per cent. Average length of time in hospital, 20 days. Prolongation of life for one year, 59 per cent. Prolongation of life for two years, 36 per cent. Cured (no recurrence at end of three years), 34 per cent. Recurrence took place in one year in 21 cases. Recurrence took place in two years in 28 cases. Recurrence took place locally in 15 cases. Recurrence took place in lung in 6 cases. Average length of time in recurrent cases from operation to death, 1 year, 2 months, and 20 days. Average length of time from period of recurrence to death, 5 months. C. A. McWilliams (*Med. News*, Apr. 28, 1900).

In all recent or primary cases complete excision is the only resource. Mercurial cataphoresis should have the preference in the secondary cases, especially when the subjacent lymphatics are extensively involved, in recurrence after operation and in all inoperable cases as a palliative measure. Oöphorectomy is indicated prior to the menopause in all recurrences and inoperable cases, regardless of other treatment, if the condition of the patient is not so bad as to make it extremely hazardous to life. Repeated x-ray exposures should be made in most instances till some local reaction appears, and be repeated from time to time if improvement follows. Thyroid extract should be administered in every case

along with other treatment and continued till its physiological effect is obtained. Until a specific effect is produced several of these methods in combination should be tried where possible. F. G. du Bose (*Mobile Med. and Surg. Jour.*, June, 1902).

A class of cases in which forbearance should be the rule is that occurring in old women, in whom a cancerous growth may, without giving rise to serious suffering, extend over several years: ten to twenty sometimes. An operation in such cases would soon be followed by recurrence and earlier death. Encephaloid growths occurring in young women seldom warrant operative procedures when at all advanced. Their evolution is extremely rapid in such cases, and excision is almost always followed by recurrence.

Barring the above-mentioned features, extirpation is indicated in every case. Many prominent surgeons, indeed, recommend the removal of all benign growths, since they often become the foci for the development of malignant neoplasms. Even when relapses occur successively, the operation prolongs life, tranquillizes the patient, and greatly decreases her sufferings. When in addition the increasing proportion of cures afforded by modern thoroughness and antiseptic methods is considered, the duty of the medical attendant becomes imperative.

The prohibitive features enumerated having been eliminated by a careful examination, the supraclavicular spaces and axillæ should be carefully examined for enlarged glands. When enlarged supraclavicular or axillary glands are detected their influence upon the surrounding tissues is a good gauge as to their size. The presence of pain, slight œdema, stiffness, etc., should be carefully looked into, and, if none of these are complained of or detected, the



chances that the glandular involvement is slight are very great. Some surgeons recommend an exploratory incision under anæsthesia to ascertain that the glandular involvement before operating is not excessive. This is unnecessary, since the necessity of such a step proves that the case is an operable one.

OPERATION. — The most promising procedure is that of Halsted, who contends that the pectoralis-major muscle entire, except its clavicular portion, should be excised in every case of cancer of the breast, because the operator is enabled thereby to remove in one piece all of the suspected tissues. J. Collins Warren also emphasizes the importance of thorough removal of all suspicious tissues, including a large margin of the cutaneous covering of the breast, a careful deflection of the edges of the wound, removal of the subcutaneous fat for a considerable distance around the mammary gland, the removal of the pectoral muscles, and a minute and painstaking dissection around the sheath of the axillary vessels. Arbuthnot Lane also removes the pectorals, carefully dissects away every particle of glandular and areolar tissue from the axilla; also, if necessary, dividing the clavicle, and clearing out the subclavian triangle if need be.

What such thorough work affords in results is well illustrated in J. Collins Warren's report, in which 22 cases operated upon under the improved technique gave 8 cases cured, a percentage of  $36\frac{3}{10}$  per cent.; all cases in which recurrence had not taken place had not occurred at the end of three years.

Three years ago 61 cases operated upon at periods varying from one month to six years were described; in 21 of these from three to six years had then elapsed since the date of the operation. From three to nine years have now elapsed

since these 61 cases were operated upon. Their present condition, as far as it has been possible to ascertain, is: Of the 61 patients 30 remain free from recurrence.

Further list of 38 patients operated upon up to the end of 1897. In these from one to three years have elapsed since the operation: 26 patients remained well without recurrence; one refuses to say how she is, but appears well; in 1 the result is unknown; 1 died suddenly about a fortnight after the operation; 7 died of recurrence; 1 recurred and has probably died; in 1 the disease recurred slightly, has been operated upon, and appears well.

In the total of 99 cases above, in which from one to nine years have elapsed since the operation, 56 certainly have as yet had no recurrence.

Conviction that about 50 per cent. of all cases of cancer of the breast will recover from the operation and remain free from recurrence if the original procedure is drastic enough. Especially is it necessary that the removal of the skin should be free. The patient's chance lies in the first operation. Watson Cheyne (*Lancet*, Mar. 18, '99).

The breast should first be carefully cleansed and aseptized as far as possible and the axilla shaved and treated in the same manner. The incision is then begun at the anterior axillary fold, and, describing an ellipse embracing the whole gland, is then brought back to the starting-point. The skin and fat of the regions traversed should be penetrated down to the muscular tissues beneath, the organ being then detached from below upward, *i.e.*, progressing toward the axilla.

The supraclavicular region is almost invariably cleansed out by Halsted (*Trans. Amer. Surg. Assoc.*, '98) at this stage, and he found that removal of the supraclavicular fat and lymphatics is best done from within outward and from below upward. The subclavian vein being the starting-point in the dissection of both the infraclavicular and supra-

clavicular regions, it is unnecessary to remove the clavicle and useless to divide it. By elevating the shoulder the clavicle can be raised an inch or more away from the first rib. The fingers can be pressed from the supraclavicular to the infraclavicular and to the subscapular regions under the clavicle, and any fat in the latter region, near the internal or the posterior border of the scapula between the serratus magnus and subscapular muscles, which could not be drawn out through the neck. To excise the supraclavicular tissues a vertical incision is used parallel with the sterno-cleido-mastoid muscle near its posterior border; a few of the posterior fibres of this muscle are divided and the junction of the internal jugular and subclavian veins is exposed. At the angle of junction of these veins the dissection is begun. The omohyoid is divided at its tendinous part, the two bellies of this muscle being drawn out of the way. The supraclavicular fossa is cleansed out or stripped, with very few exceptions, at the primary operation. The rule should be to operate on the neck in every case. The minor as well as the major pectoral muscle is removed; the insertion of the major, and then its origin and the origin of the minor being divided, before the subclavian vein is exposed, first at its inner part; and the axilla stripped of its contents and its anterior wall at one time from within outward and from above downward. The mass to be excised must always be circumscribed with a circular or an oval incision, and an additional cut made to expose axillary and jugular veins. The operation is performed in an absolutely bloodless manner. In all cases the wound is grafted immediately; this is done by cutting grafts from the patient's thigh as large as or larger than one's hand. A single one of these large

grafts may be enough to cover the raw surface. In cutting a graft of this kind the skin is made tense by a board which the operator slides along the thigh just in front of a large amputating knife or catlin. The graft is spread, raw side up, on a piece of rubber tissue, and from the latter is readily transferred to the breast-wound. It is finally covered with silver foil and tissue-paper, and need not be looked at again for two or more weeks.

When such radical measures are not required, and a simpler operation is warranted by the limits of the tumor, the following procedure may suffice: The breast is carefully aseptized by washing, and bathed with a mercuric-bichloride solution, and the axilla is shaved and treated in the same manner. An incision is then made, also from the axilla, but anterior to it, extending downward and around the tumor, the latter being included in the ellipse formed, and meeting the starting-point. Even if the growth be exceedingly small, a wide margin should be removed with all suspected tissue. The knife should penetrate clear down to the muscular aponeurosis, from which the mass can easily be detached; but if the aponeurosis is adherent it must be removed. If any muscular fibres also show adhesions, the Halsted operation should be resorted to. The vessels should be rapidly caught to avoid hæmorrhage as the case proceeds.

Examination of the axillary ganglia is warranted in all cases, and their careful dissection is always indicated, when there is the least suspicion that they may be involved. They are unmistakably so in over 60 per cent. of cases. The wound is then to be carefully washed with a bichloride solution, after carefully arresting all the bleeding vessels. The antiseptic solutions used should be luke-



warm, to prevent chill, the operation being rapidly performed in a warm room for the same reason. The two edges of the wound should then be sutured, after having placed a drain at each end of the wound. The whole should then be dusted with iodoform, and covered with a thick layer of antiseptic absorbent cotton, held in position by a broad bandage tightly fastened around the chest. When antiseptic precautions have been carefully carried out, union takes place at once. The dressing should not be removed until the third or fourth day, to remove the drains and sutures. These should be replaced by strips of linen impregnated with iodoform collodion.

When the breast has been removed it is important to ascertain whether any cancerous tissue has been left. This is ascertainable at least as far as the tissues through which the incision has passed, by means of the proceeding recommended by Stiles, of Edinburgh. He gives the steps of the procedure as follows: "1. Mark the position of the breast by a slight incision extending both on the breast and on the skin which is to be left. This is to enable the operator to identify the position, and therefore the corresponding surfaces of the breast and the wound after the removal of the breast. 2. Wash the breast in water to remove all traces of blood. This is important, because after treatment with nitric acid the blood becomes blackened and difficult to remove, and therefore greatly obscures the appearances which the acid brings out. 3. Submerge the whole organ in a 5-per-cent. aqueous solution of nitric acid (B. P.) for about ten minutes; that is to say, during the time the surgeon is clearing out the axilla. 4. Wash in plenty of running water for five minutes. 5. Place in methylated spirit (undiluted) for two

or three minutes. 6. Examine the whole surface very carefully to ascertain (a) whether any part of the tumor is exposed upon the surface, (b) whether any locally-disseminated cancer-foci are exposed upon the cut surface, or (c) whether breast-tissue is exposed."

All the cancerous tissues treated in this manner are rendered a dull, opaque white, indicating that more tissue must be removed from the corresponding spots in the wound.

TREATMENT OF INOPERABLE CASES.—When the growth cannot be removed, palliative measures must be adopted. The organ must be relieved of all pressure, and the movements of the corresponding arm restricted as much as possible. The use of morphine and atropine hypodermically in such cases is fully warranted, the object being to curtail suffering, even if very large doses have gradually to be reached. Locally, boric acid, directed over the growth, or a solution of acetate of lead, 20 grains to the ounce, sprayed over it, are useful procedures. Local applications of solutions of the extract of opium or belladonna sometimes quiet the suffering.

Bernart recommends, as a curative measure in inoperable cases, interstitial injections of a solution of salicylic acid, 15 minims to 1 drachm of a 6-per-cent. alcoholic solution being used after strict antisepsis. From 10 to 15 injections are said to produce considerable alleviation.

Hasse, of Nordhausen, has used injections of alcohol for more than 20 years in the treatment of inoperable cancer, and 4 cases of this kind in his practice are now cured. He uses the same method in cancer of the breast, and believes that cure could be effected in these cases by surrounding the breast with cicatricial tissue by means of alcohol injections. It is preferable, however,

to extirpate the breast and treat recurrences by the injections. In this manner he obtained radical cure in a case declared inoperable by Volkmann. Vulliet, of Geneva; Kuh, of Chicago; Young, of Bloomington; and others have also obtained good results from this method. Hassel used alcohol diluted one-half, or even more with very sensitive patients, having found it less painful, while equally effective. One, or at most two, injections are made at a time, drawing the breast out and inserting the needle in such a manner as to cause the alcohol to penetrate into the retromammary cellular tissue beyond the middle of the gland. The contents of the syringe should flow out gradually on gentle pressure of the piston. If there is resistance it should be withdrawn a little and the point inserted sidewise in another direction. In this way the retromammary space is filled with the alcohol, 4 to 10 cubic centimetres for small tumors and 10 to 20 cubic centimetres for larger ones. One must be careful to keep well in the space behind the tumor. After the needle is first introduced it should be withdrawn to see if any blood flows out of the needle-hole, showing that the needle has penetrated a blood-vessel. If it has, the syringe must be cleansed and inserted in another place. The injections are made once or twice a week at first, and then later once in two or three weeks. These injections are, unfortunately, rather painful. Another method which has, of late, afforded encouraging results is the use of the Roentgen rays.

Case of carcinoma of the breast too far advanced for operation in which the use of the x-ray for nine weeks produced a marked improvement. In this case the rays were applied for fifteen minutes at a time for five days out of a week. The ulceration and discharge greatly dimin-

ished, and the axillary glands became smaller and general improvement followed. Andrew Clark (*Brit. Med. Jour.*, June 8, 1901).

Case of recurrent carcinoma of the breast which was markedly benefited by x-ray treatment. Three years before the patient had had the breast amputated. Both the sternum and the axilla were infiltrated with the recurrent growth. The rays were employed on twenty successive days, the applications lasting twenty minutes. The growth has become much smaller and the pain and ulceration have disappeared. G. B. Ferguson (*Brit. Med. Jour.*, Feb. 1, 1902).

Case of scirrhus of the breast treated by the x-rays. The original growth was removed thirteen years, and the recurrence was first noticed five years, before the patient came under observation. Ten applications were made at intervals of about three days, the exposures lasting from ten to twenty minutes. This growth decreased from 3 inches in diameter to  $1\frac{3}{4}$  inches, the ulcer became smaller, and the pain and discharge markedly lessened. At this period the patient developed a croupous pneumonia, from which she died. Peters (*Brit. Med. Jour.*, March 1, 1902).

Case of ulcerated cancer of the breast under treatment at St. Bartholomew's Hospital, the patient when admitted having a large, open, ulcerated wound of the right breast, measuring about four inches in one diameter and five inches in the other. Treatment with x-rays was commenced on November 14th and an exposure of ten minutes was given four times a week, with few omissions, until January 17th. After a few days signs of healthy cicatrization began to appear around the margins of the ulcer. This continued to advance until the healing process had extended inward from the margin for a distance of fully half an inch all round. The centre of the wound gradually ceased to slough and appeared to be in process of healing all over; but the patient being at a late stage of her illness, secondary deposits in remote parts of the body became disagreeably evident, and the x-ray treatment was suspended in view of the hopelessness of



the future of the patient. The total number of exposures was seventeen, and it was very important to note that many were made with the ulcerated surface covered by dressings or bandages. Since the suspension of the treatment, exactly four weeks ago, the process of healing had gone on quite steadily, and at the time of the report there was a firm and healthy scar covering the whole surface, except about one square inch in the centre. This portion was also a healthy healing surface, though not yet covered by epithelium. The local effect was splendid, but there was no influence upon the spread of the disease in the remote parts of the body. H. Lewis Jones (Lancet, Feb. 22, 1902).

**Removal of Benign Tumors of the Breast.**—The operation does not vary from the simpler operation used for cancer, but removal by raising the mamma as a flap from the chest-wall and extracting the tumor from behind, first suggested by Gaillard Thomas, may sometimes be used. In a case operated by T. S. K. Morton, in which a benign growth was to be removed, it was found easily feasible to turn up the breast as a flap or trap-door so as to extract the growth without leaving a disfiguring cicatrix. An incision five inches in length was made, semicircular in form, in the line of the fold formed at the junction of the lower portion of the breast-skin with that of the chest-wall. This was carried down through a considerable amount of fat until the sheath of the pectoralis major was exposed. The loose cellular attachments of this to the capsule of the breast were then with great ease broken up by blunt dissection and an occasional snip of the scissors until the breast could be turned upward upon the chest-wall below the clavicle. The posterior wall of the capsule was now opened in a direction radial to the nipple over the tumor. This was found

to be capsulated and very loosely adherent to the pocket among the gland-acini, which it had evidently formed by its movements. Blunt dissection by a forefinger freed it at a sweep at all points save the upper and outer, where a firm adhesion was discovered, which required division by the knife, but without opening the capsule of the growth. No ligatures were required. The gland was turned down into its normal position and the skin-margins of the wound united by a subcuticular continuous silk suture.

While this method is of value in closely-diagnosed cases, the operator must not be tempted to use it where there is the least doubt of the non-malignant character of the disease.

#### **Tuberculosis of the Breast.**

There are two characteristic varieties of mammary tuberculosis: the *disseminated* nodular form and the *confluent*. The nodular variety is characterized by the development of single or multiple hard nodules, only slightly painful and at first non-adherent to the skin. The process is exceedingly chronic, and only after the lapse of several years do the nodules break down and form suppurating fistulas. The confluent variety is characterized by a more acute onset, greater pain, and rapid enlargement of the breast. It is more common than the nodular variety. Retraction of the nipple has been reported in two cases. If the disease extends to the axillary glands, it pursues a much more rapid course than in the mammary gland. Occasionally the tuberculous process leads to the formation of a cold abscess, but this is rare, and never occurs before puberty. In many cases it is impossible to establish a diagnosis of tuberculosis; but, when the disease is far advanced or there are foci of the same trouble in

other organs, the diagnosis is comparatively easy. (A. E. Halsted and E. R. le Count [Annals of Surg., Dec., '98].)

**SYMPTOMS.**—The symptoms of tubercular mastitis are pain and tumor. The tumor may consist of one or more nodules, firm, hard, and freely movable with the gland. The skin may be freely movable over the growth, but frequently is attached. The nipple may or may not be retracted, and occasionally the entire breast becomes involved in one large, nodular, unyielding, brawny mass. The diagnosis is usually difficult, and is most important when the differentiation between tuberculosis and carcinoma is imperative. Under certain conditions it is impossible to distinguish them clinically. The infallible means of differentiation are the microscope and bacteriological culture. The axillary lymphatics are enlarged in three-fourths of all secondary cases; in other instances axillary involvement may be apparently absent; occasionally cervical glands are also infected. (C. C. Warren [Med. Rec., Oct. 1, '98].)

**ETIOLOGY.**—Of the cases of tuberculosis of the mammary gland, 89  $\frac{6}{10}$  per cent. occur in females. The disease is most common between the ages of twenty and thirty-five. Mammary tuberculosis may be primary, depending on infection through the milk-ducts or fissured nipples; or secondary, the disease extending from contagious foci in the chest (C. C. Warren). According to Reerink (Beit. zur klin. Chir., B. 13, H. 1, '95), extension from surrounding structures is the commoner method.

**TREATMENT.**—The treatment of primary mammary tuberculosis, as recommended by A. E. Halsted and E. R. le Count (*loc. cit.*), consists in complete removal of the breast and axillary glands. In the rare cases of cold abscesses these

may be aspirated and iodoform emulsion injected.

## TUMORS OF THE LARYNX AND LUNGS.

### Tumors of the Larynx.

**Symptoms.**—The location of a laryngeal tumor, its size, and its nature bear considerable influence upon the symptomatology. A growth situated anteriorly in the anterior commissure may, though small, so prevent approximation of the cords as to cause complete loss of voice; on the other hand, a large soft growth located below the cords may not interfere with adduction and only give rise to the symptoms of chronic laryngitis. Paroxysmal hoarseness is often observed in such cases, especially after loud talking or laughing. A small tumor situated above the cords may also give rise to very little trouble and cause no subjective symptom. In the great majority of cases, however, persistent hoarseness is the first manifestation. Dyspnoea follows and gradually increases until orthopnoea is threatened. If at this stage the nature of the trouble be not recognized and the growth extirpated, the patient dies asphyxiated. Small growths with long pedicles are apt to titillate the laryngeal mucous membrane, and give rise to cough or spasmodic retching. A rattling noise or coarse gurgling is also sometimes heard when such growths are present.

Laryngeal tumors may be *benign* or *malignant*.

**Benign Tumors.**—Benign tumors usually grow slowly, and dyspnoea only comes on late in their history, unless an acute cold or any local inflammation causes temporary infiltration of the tissues, when dangerous symptoms may suddenly supervene.

**Singers' Nodes.**—These small growths,



usually observed on the superior surface of the cords, or near their edge, and usually in the anterior thirds, are the result of overuse of the voice. The first manifestation is fatigue unusually soon after beginning to sing; this is followed by gradually increasing hoarseness. The tumor varies from a pin's head to a small split pea, in size, and forms the centre of an areola. Often the same spot in the opposite cord is also the seat of a growth. There are often several on both cords.

*Papilloma*.—This variety of growth is commonly met with, especially in children, and represents over one-half of all laryngeal tumors encountered in practice. It is ascribed to inflammatory disorders of the larynx, especially when in subjects suffering from diathetic disorders, or showing familial traces of syphilis or tuberculosis. They are often attached to the anterior portion of the cord, near the commissure, and may be sessile or pedunculated. The numerous papillæ cause their surface sometimes to resemble that of a raspberry, especially when dark red in color. They may be yellowish, white, or pinkish. They are occasionally observed at birth, the infant being aphonic and showing evidence of dyspnœa. Digital examination is necessary to recognize the condition in small children. These growths are only benign in young subjects, but when they occur after middle life they should be looked upon with suspicion. Tuberculous growths of the larynx may be taken for a papilloma.

*Fibroma*.—Fibromata may be assimilated to nasal polypus, though they are more opaque and resistant to pressure. They are smooth and usually sessile or pear-shaped, may be whitish gray or reddish, the latter color being due to sanguineous extravasation, through coughing, hemming, etc. They are generally found near the anterior commissure upon

the cords, below them, or upon the ventricular bands. They sometimes become sufficiently large to completely fill the larynx and cause asphyxia. Overuse of the voice is also thought to be their main cause; they are usually found in men.

The other varieties of benign growths occasionally met with in the larynx are *cysts*, *angioma*, *chondroma* and *adenoma*, and *lipoma*.

**TREATMENT OF BENIGN TUMORS.**—In singers' nodes rest is the first requisite, talking especially being as much as possible avoided. The local use of astringent solutions is generally useless. The local application of chromic acid with a suitable instrument and by an expert, or galvano-cauterizations, or, again, the use, for sufficiently large growth, of the laryngeal forceps, alone affords satisfactory results.

In the cases of all other benign growths removal is also necessary. In small sessile growths this may sometimes be accomplished by chromic acid or galvano-cautery. As soon, however, as a neoplasm reaches beyond the dimensions of a split pea, removal with forceps, Fauvel's or Mackenzie's, should be resorted to, after anæsthetizing the larynx with a 20-per-cent. solution of cocaine. Tracheotomy sometimes becomes suddenly necessary when the growths are large. General anæsthesia under such circumstance can rarely be used, lest the saturation of the pulmonary residual air with the anæsthetic cause death. Benign tumors do not recur at the same spot, if they recur at all.

**Malignant Tumors.**—The proportion of malignant as compared to benign growths, as shown by Semon's statistics is about 1 to 7, but the fact that the former are more likely to be reported than the latter would tend to suggest that this proportion is fallacious. One ma-

lignant case in 20 cases would, judging from the specialist's average experience, probably be nearer the truth.

CARCINOMA.—Cancer of the larynx is somewhat more frequently observed in men than women, and, as is the case with this variety of growth in other parts of the organism, the majority of cases, about 66 per cent., are observed in subjects between the fortieth and sixtieth years. Cases are, though rarely, met with in children. Epithelioma is the variety usually observed, though all forms of cancer, even scirrhus, have been encountered in this situation.

Besides the symptoms observed in other forms of laryngeal tumor, hoarseness, dyspnœa, cough, etc., glandular enlargement in the neck, and dysphagia usually appear, sometimes early in the history of the case. Pain, another feature not complained of in benign tumors, is quite a prominent symptom and in some cases becomes intense. It is usually of a lancinating character and in some cases radiates toward the ear. The breath is foetid, the general health is undermined through general toxæmia and deficient nutrition, and death usually occurs from exhaustion. In some cases, however, ulceration through the coats of a large artery may cause sudden death from hæmorrhage; fatal pneumonia may be brought on by the aspiration of *detritus*, or asphyxia may be induced through the entrance into the laryngeal aperture of masses of food.

The laryngoscopical image afforded at first varies greatly in different cases and according to the location. It may at first resemble a benign tumor, and be taken for it; one cord may simply be enlarged, rounded at the edge, and slightly congested; a small ulcer, resembling an abrasion, may suggest syphilis, especially when the edges of the ulcer are sharp-

cut and yellowish; a grayish projection or ulcer may suggest tuberculosis, etc. Elimination by examining the sputa for tubercle bacilli, or the administration of iodide of potassium is often necessary in such cases to determine the true nature of the growth, and sometimes a small piece must be nipped off with forceps for microscopical examination. The development of the tumor is also irregular. Fungous masses, burrows, masses of necrosed tissue, and thick secretion, etc., make up a picture that is never forgotten when once seen.

The chances of recovery are absolutely *nil* when an early operation, including thorough removal of the growth, cannot be carried out. When such a procedure can be resorted to satisfactorily the prognosis becomes comparatively favorable.

TREATMENT.—The safest rule as to the extirpation of laryngeal carcinoma resumes itself into instrumental methods whenever the case is seen near its incipency. If there appears, after careful examination, to be no peripheral involvement, and the growth is so situated that it can be, as it were, punched out with considerable surrounding tissue with special cutting forceps, this should be resorted to. An ulceration or thickening near or the edge of a cord or a ventricular band may thus be enucleated. Such cases are unfortunately comparatively rare, and the laryngologist is usually consulted when the cancerous process has already advanced beyond this comparatively simple procedure. Excision then affords the only procedure capable of affording some chance of recovery. It is now advocated by most experienced laryngologists when the limits of the thyroid cartilage are not passed; that is to say, when only the tissues *within* the larynx proper are involved and when there is no glandular enlargement. Local



applications of acids, cautery, arsenic, etc., but stimulate the development, and are therefore more hurtful than beneficial.

Review of all cases so far reported as treated by the x-rays and failure to find a single instance in which a cure was claimed. Although the good results which have been obtained from the action of these rays in malignant growths elsewhere would lead one to hope for great benefit to the laryngeal cases, yet the evidence thus far available is too meagre to warrant taking very great chances. In early cases the only safe way, therefore, at the present time, is to recommend the radical operation of extirpation, for that offers a good percentage of permanent cures. D. B. Delavan (Medical Record, Oct. 18, 1902).

Case of laryngeal cancer treated by applications of the x-rays. The patient came under treatment in June, seemed cured by August, and was found in excellent condition in October. The aphonia which followed immediately after the treatment has been partially overcome by compensation by the remaining cord. This condition has gradually improved by constant practice. Scheppegegrell (New York Med. Jour., Dec. 6, 1902).

To assuage the sufferings of the patient, much can be done. The insufflation of orthoform or the local application of a cocaine solution before meals to the ulcerating tissues enables the patient to swallow his food. When he can no longer do this, a stomach-tube or a large rubber catheter may be introduced alongside the growth, into the pyriform sinus, and the patient fed through it with nourishing liquids: milk and cream, soft-boiled eggs, broths, etc.

Tracheotomy, early in the case, when laryngectomy cannot be performed, by giving rest to the larynx seems to stay the progress of the growth. It should be performed low down and under strict antiseptic precautions.

**SARCOMA.**—Sarcoma, according to

Gurlt's statistics as quoted by Bosworth, occurs once in the larynx in every eight hundred and forty-eight cases of this form of tumor met with, while general average of the cases reported by various observers would place the relative number of cases of laryngeal sarcoma as compared to laryngeal carcinoma at 1 in 23.

As is the case with carcinoma, it may occur in any part of the larynx, but with a predilection for the vocal cords. The yellow color of sarcoma as compared to carcinoma, which is usually reddish at the start, the globular or rounded surface as compared to the ulcerative process observed early in the latter, and slower growth are important features, but the diagnosis should invariably be verified microscopically. The subjective symptoms are not usually as severe; indeed, the patient may otherwise be in excellent health as witnessed in case seen myself, and to all intents and purposes the case may simulate in this particular a benign tumor.

*Treatment.*—Early extirpation of the growth affords a far better prognosis than when carcinoma is present, since glandular involvement occurs later. When the tumor has involved the greater part of the larynx, laryngectomy should be resorted to.

### **Tumors of the Lung.**

Benign tumors of the lung are, as a rule, of but little clinical importance. Being usually small, they involve but limited areas of pulmonary tissue, and, therefore, give rise to no special discomfort, especially when their development is insidious. *Lipomata*, *chondromata*, *osteomata*, and *adenomata* are the varieties usually found at autopsies.

Malignant growths, on the contrary, are comparatively common, carcinoma (about 1 in 500 autopsies—Wolf), *sarcoma*, and *endothelioma* being observed.

A single lung is usually attacked, but the other may become involved through metastasis, if the patient's life is sufficiently prolonged. Both lung and pleura are involved conjointly in some cases, the line of demarkation between the two structures being lost.

**Malignant Tumors of the Lung.**—**CARCINOMA.**—Two groups of primary carcinoma of the lung are recognized clinically by Pässler (Virchow's Archiv, B. 145, '96), the division being based upon the anatomical location of the growth. The first group comprises the cases in which the growth is situated along the course of the bronchi at some distance from the root of the lung. These cases often run a course for a long time resembling that of chronic tuberculosis. Later on there usually occur complications in the form of bronchiectasis, pneumonia, and gangrenous processes.

The second group of cases comprises those in which the carcinoma develops at the root of the lung. In these the symptom-complex is much like that of the mediastinal tumors. Both groups, however, have in common the cachexia, metastasis, cough, and expectoration.

Among the important signs in carcinoma of the lung are consolidation of one lung with increase of the thorax on the affected side, or retraction of the same side; bronchial irritation, cough, and expectoration; pleurisy, with fibrinous, serous, hæmorrhagic, purulent, or putrid exudate; symptoms of pressure upon the nerves or veins, and finally cachexia. The discovery of signs of consolidation of the lung of progressive character, and only a moderate catarrh of the bronchi with scanty expectoration, may lead to suspicion; but hæmorrhagic sputa is more significant. The color and character of the sputum, the "prune-juice" sputum, is usually thought to be

characteristic. All that can be said is that the character of the sputum is often hæmorrhagic, while there is no characteristic tint. There may be but little expectoration, and sometimes none at all. It may be gangrenous. Dyspnœa, sometimes accompanied by cyanosis, is a very constant sign.

Case-histories of cancer of the lungs, 5 in males and 5 in females. In 3 cases the cancer was alveolar; in 6 cases it was bronchial. Tuberculosis was also present in 4 cases. Dömeny (Zeits. f. Heilkunde, Oct., 1902).

When cells are found which plainly differ from the ordinary pavement and cylinder cells of the mouth or air-passages—cells which are non-pigmented, polymorphous, polygonal, of various sizes, including sometimes giant cells, with plain nucleus and nucleolus, single or in masses—the diagnosis of new growth is permissible (Hampeln, Zeit. f. klin. Med., B. 32, p. 247). The symptoms are sometimes hardly perceptible, not only at the start, but also when the disease has involved a considerable portion of the lung.

Very frequently the earlier stages of the disease are accompanied by no very prominent symptoms. Even the entire course of the malady may be accompanied by symptoms so slight and so indefinite in character that the attention neither of the patient nor of the medical attendant is directed toward the lungs as the seat of disturbance. I. Adler (N. Y. Med. Jour., Feb. 8, '96).

Cancer is also recognized with difficulty when a concomitant affection—tuberculosis, for instance—is present. This has been repeatedly observed. Involvement of the lymphatics is an irregular complication.

When the pleura is the main centre of the lesion, the effusion of fluid into the pleural cavity stands prominent among



the clinical symptoms, and dominates the entire clinical aspect. Whenever in such a case the aspirated pleural exudate is sanguinolent, and tuberculosis can be excluded, there is strong ground for suspecting a tumor (Adler). According to Hampeln, a cancerous effusion is distinguished by its tendency to repeatedly recur after aspiration.

The diagnosis is easier in a case of lung carcinoma, especially when the tumor is situated near the pleura, than in a case of bronchial carcinoma. In the former instance a circumscribed dullness in conjunction with great wasting, and catarrhal sputum free of bacilli, but occasionally bloody, may suggest the affection. Pain is occasionally present, but naturally dyspnoëic symptoms are more common to bronchial carcinoma than to lung carcinoma. Implication of the bronchial glands often manifests itself by dyspnoëa or recurrent paralysis. Metastasis is more apt to occur with bronchial than with the proper lung carcinoma. The presence in the sputum of particles of the tumor is rare, as it was observed in only one of thirty-one cases. Wolf (*Fortschritte der Med.*; *Med. Record*, May 16, '96).

The Roentgen rays may enable a diagnosis of lung tumor to be made at a time when percussion can detect no abnormality. Leo (*Berl. klin. Woch.*, Apr. 18, '98).

Through stenosis of the bronchi involved in the cancerous areas, areas totally devoid of air not only elicit dullness on percussion, irregularly distributed, but the respiratory and vocal resonance are correspondingly modified.

**SARCOMA.**—The clinical signs of sarcoma do not vary to a great extent from those of carcinoma, though, on the whole, they appear to present a greater degree of variation.

Schwalbe is of opinion that a rather intense stridorous respiration speaks more for sarcoma, inasmuch as the latter tends to more bulky enlargement of the lymph-glands, and, therefore, to an

earlier and closer bronchostenosis than carcinoma. The earlier years of life incline more to sarcoma, the senile period more toward carcinoma. I. Adler (*N. Y. Med. Jour.*, Feb. 15, '96).

The principal diagnostic signs, according to Bock, are the peculiarly even distension of that side of the barrel-shaped thorax; the stretched, but not bulging, intercostal spaces; the passive dilatation of the superficial veins of the affected side; the greater resistance felt by the finger on percussion; and the total absence of respiratory sounds of the affected side. These cases occasionally run a rapid course.

**Etiology.**—In 31 cases of primary carcinoma of the lungs occurring in over 7000 autopsies analyzed by Wolf (*Fortschritte d. Med.*, Nos. 18 and 19, '95), 27 of the patients were men and 4 were women. The right lung was affected 5 times, the left lung 3 times; the right bronchus 13 times, the left bronchus 8 times; both bronchi were involved twice. In 13 of these cases tuberculosis was a complicating condition. Metastasis was more likely to occur when the primary tumor affected the bronchi than when it affected the lung.

The middle and late years of life, as in carcinoma elsewhere, offer the greatest number of cases, while sarcoma occurs early in life, sometimes during infancy.

Workers in cobalt mines offer a predilection to primary pulmonary cancer, a large proportion of them dying of this disease.

**Pathology.**—I. Adler recognizes four general forms of carcinoma: the cylindrical-celled, the pavement-celled, the medullary, and scirrhus forms, the cancers originating in the bronchial mucous membrane being generally composed of cylindrical cells. True pavement-epithelium-cell epithelioma has been observed by Ehrlich, while Grünwald, Fuchs, and

Wolf have found the epithelium of the alveoli to be the starting-point for cylindrical-cell and pavement-cell cancers. The neoplasm may be diffuse, or occupy restricted areas in the form of nodular masses, which may be numerous, or restricted in number. The diffuse variety starts from a bronchial focus and proliferates into the peribronchial and perivascular lymph-spaces in all directions. The nodular form may involve the greater portion of a lobe, completely transforming its structure. They show, according to Adler, a distinct tendency to softening and degeneration.

Primary epithelial carcinoma of the lung may arise (1) from the alveolar epithelium; (2) from the epithelium of the bronchial mucous membrane; (3) from that of the bronchial glands. Primary endothelial carcinoma may arise (a) from the endothelium of the superficial lymphatic vessels of the pleura, and (b) from the pulmonary lymphatics. Siegert (*Virchow's Archiv*, B. 134, H. 2, '94).

**Treatment.**—Pneumonectomy, according to Réclus, is permissible in exceptional cases and when a neoplasm extends from the thoracic wall to the lung. Abstinence is preferable, however, in primary cancer, since, on the whole, the results have been disappointing through the fact that the growth had involved the tissues extensively before a diagnosis had been established with sufficient certainty to warrant an operation. Aspiration when the pleura is the seat of the neoplasm sometimes relieves the sufferings of the patient, though the infiltration usually recurs repeatedly.

Solid tumors should be extirpated when superficial, taking advantage of adhesions when any exist and establishing adhesions when those present are not of sufficient extent. Péan (*La Presse Méd.*, Oct. 23, '95).

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## TUMORS OF THE RECTUM AND ANUS.

### Benign Tumors.

The benign tumors are usually divided into the (a) adenoma, (b) fibroma, (c) papilloma, (d) lipoma, (e) teratoma, (f) enchondroma, (g) angioma, and (h) cystoma.

ADENOMATA, OR SOFT POLYPI, are probably the most frequent form of the benign neoplasms met with in the rectum. They occur with the same relative frequency in both of the sexes and especially between the ages of three and twelve. They vary in size from that of a small pea to that of a large chestnut, although cases are on record in which the tumor has been considerably larger. Their shape is more or less globular or pyriform. The surface is usually lobulated and nutmeg-like. It is attached to the rectal wall by a narrow, but often elongated, pedicle. Arterial pulsation can frequently be felt within the pedicle, as it is through this stem that the blood-supply of the growth is furnished. The vessels conveying the same are often of fair size. This fact is of importance, as it may account for the excessive bleeding which occurs in spontaneous detachment of such tumors.

Cooper and Edwards state that these growths closely imitate the normal mucous membrane in structure, though their glands are larger, more abundant, more branched and convoluted, and less irregularly disposed. They also ascribe their greater frequency in the rectum than elsewhere to the fact that this portion of the intestinal tract is more liable to irritation.

FIBROMATA.—These tumors take their origin from the submucous or connective tissue of the bowel, are more or less pedunculated, and vary with regard to their relative firmness. Messrs. Allingham



state that all of the very dense fibrous polypi that they have met with have been as large as an English walnut; that they creak when cut, and the incised surface is of a pale color. Such growths they consider quite exceptional specimens of this form of tumor. The small polypi so frequently seen in connection with fissure and with hæmorrhoids are due to an hypertrophy of the upper extremities of the columns of Morgagni. Unstriped muscular tissue is sometimes found intermixed with the fibrous tissue of these growths, and, according to Cooper and Edwards, it may form the greater portion of the tumor. Usually these tumors are single, but occasionally they are multiple, and, in rarer instances, disseminated over quite an extensive area of the bowel. The surface of these growths is usually smooth, and they are apt to be pear-shaped.

**PAPILLOMATA.**—These growths are variously termed by different authorities as “villous tumors of the rectum,” “villous polypus,” and “granular papilloma.” According to Ball, they are a rare form of rectal growth, resembling the villous tumor of the bladder, in general appearances, with the slight difference, however, that the lobes in the growth occurring in the bladder are more filiform, while in the rectum they are flattened or club-shaped. They are composed of the papillæ of the mucous membrane, which have proliferated freely, and are covered with cylindrical-celled epithelium. Papillomata are attached to the wall of the bowel by a more or less broad pedicle, but they are occasionally sessile. They bleed freely and occasion more or less mucoid discharge. They may protrude from the anus.

**LIPOMA.**—Tumors composed of adi-

pose tissue have also been observed in the rectum.

**TERATOMATA, OR DERMOID CYSTS,** are very seldom found in this situation. They differ in no respect from the same growth as found elsewhere in the system.

**ENCHONDROMATA, OR CARTILAGINOUS GROWTHS,** are said to occur in the rectum, but they must be extremely rare.

**ANGIOMA.**—These nævoid tumors are likewise of rare occurrence in the rectum, and when they exist may occasion considerable hæmorrhage.

**CYSTOMA.**—Various cystic tumors may occur about or within the rectum, but dermoid cyst is the most authenticated variety found in this locality.

**Symptoms.**—There are no marked symptoms to be defined as peculiar to benign growths. A sensation of weight in the rectum may be experienced; shooting pains, distress in the loins or back, more or less tenesmus, and diarrhœa, with more or less discharge of mucus and of blood, are often noted. The character and intensity of the symptoms are influenced by the size and position of the growth. If situated high in the rectum, but little, if any, inconvenience may be experienced. When, however, it is attached low in the bowel, the local discomfort is complained of.

The differential diagnosis of the varieties of rectal tumors has already been sufficiently dwelt upon. Piles are not pedunculated, and a prolapse should occasion no difficulty in diagnosis. In cases of polypoid growth an enema should be administered and the entire rectum examined by first passing the examining finger as high as possible into it, then sweeping the palmar surface around the mucous membrane from above downward. In this manner the polypus may be caught between the finger and the rectal wall if present. Otherwise the

growth would escape detection by being pushed ahead of the examiner's finger.

Tumors of the rectum, especially when situated some distance up, may occasion intussusception and even prolapse of the bowel. Partial and even complete obstruction of the gut may likewise be caused. Ulceration and extensive bleeding may also be produced.

**Treatment.**—The treatment of these tumors is essentially surgical. Prompt removal is the only safe advice to give, the actual cautery or the ligature being employed. Anæsthesia may be required in some forms of this trouble before operative interference may be carried out. Small polypi may, with comparative safety, be twisted off with a pair of hæmostatic forceps.

#### Malignant Growths of the Rectum.

The rectum is one of the favorite sites for malignant growths. In this region, as elsewhere, cancer is viewed as an incurable affection, and is asserted to run its course in about two years. It usually occurs after middle life, though cases are recorded in which it attacked the very young, and, though believed to be more frequent among females, Messrs. Allingham state that in their experience many more men are victims to this disease, to which statement the limited number of cases seen by me would lend emphasis.

**Varieties.**—The forms of malignant disease met with in this locality are: (a) epithelioma, (b) scirrhus, (c) various forms of sarcoma, (d) encephaloid, (e) colloid, and (f) melanotic. In those tumors in which much fibrous tissue is mixed with the newly formed glandular structures, the growth is hard and resistant; when the neoplastic tubules are in excess, and the fibrous tissue delicate and scanty, the tumor is soft and fungous, and corresponds with the description of medullary cancer. A

gelatinous condition due to mucoid or colloid change affecting the cells has given rise to the term "colloid" as applied to such growths.

The three terms scirrhus, medullary, and colloid, signify varying conditions of a growth or parts of a growth composed essentially of glandular tubules and epithelial cells.

Cooper and Edwards (*op. cit.*, pp. 190-93) subdivide the adenocarcinoma into three forms, which may be severally distinguished as (a) the *laminar*, (b) the *tuberous*, and (c) the *annular*. Their description of these varieties is as follows:—

"In the *laminar* form, which is the most common, a portion of the intestinal wall is infiltrated or thickened, the affected area varying in size according to the stage of the disease. The thickening appears to exist between the muscular and mucous coats, and it tends to spread laterally rather than either upward or downward. Its centre is slightly raised, while the edges are beveled off. The growth is connected with and binds together all the tissues of the bowel, but at first is freely movable as a whole. After awhile the surface of the neoplasm gives way, leaving a ragged ulcer with characteristically infiltrated borders. The destruction generally begins near the centre and extends toward the circumference; but sometimes ulcers form at several points on the surface. As the process advances, the infiltration is gradually eaten away; its remains may be recognized as nodules or papillary excrescences rising from the base or border of the ulcer. In later stages the base may be smooth, hard, and clean, being formed by cicatricial tissue and the remains of the muscular coat, while the edges are hard and raised, and either tolerably uniform or beset with nodular or papillary



growths. Much connective tissue is developed beneath the base of the ulcer, and becomes constricted and puckered, as these changes are in progress. The course of the growth is sometimes different, inasmuch as the deposit is only partially destroyed by the ulceration, and its remains sprout up and form tumors projecting into the cavity of the bowel. The ulceration sometimes has another result, viz.: destruction of the coats of the bowel and perforation of adjoining viscera.

“In the *tuberos* form the growth projects into the bowel. Its consistence varies, being sometimes hard and firm and in other instances soft and fungoid. One such mass may be present; or there may be several growths of the same character, but varying in size. At first the mucous membrane, though firmly adherent to the tumor, remains intact, but is soon destroyed by ulceration, and a portion of the growth is then apt to project through the opening thus made. Sometimes the membrane gives way at several spots, at which nodules or larger portions protrude. Such outgrowths are soft and friable. Sometimes the destructive process is too rapid for the development of fungoid growths; when the surface gives way, the ulceration continues to extend deeply and superficially until the muscular coat is laid bare. The cancerous process invades the neighboring tissues and structures,—*e.g.*, bladder, urethra, or vagina,—and openings are made into these parts. The process again may extend toward the sacrum and involve the nerves and bones of the pelvis. Occlusion of the bowel by a fungoid mass is a less frequent result.

“In the *annular* form the growth begins as a deposit between the mucous and muscular coats, and extends latterally so as to involve the whole circumference of

the bowel, but does not spread upward to any great extent. The subsequent contraction diminishes the calibre of the bowel and causes a marked degree of stricture.”

**Symptoms.** — The early symptoms of cancer of the rectum are far from being characteristic. Indeed, it often exists for a considerable period before the patient is cognizant of any trouble. Frequently patients consult a surgeon about hæmorrhoids or some minor affection of the rectum or anus, and it is only after a digital examination that the presence of cancer is recognized. Generally, the first sign experienced, in cases of this disease, is a sensation of uneasiness in the lower part of the back and along the inner sides of the thighs, with possibly a similar feeling within the rectum. At the end of a day's work this may be supplanted by actual pain, of a dull, heavy character. The next and most usual symptom is morning diarrhœa. As soon as the patient gets out of bed, or soon thereafter, he is obliged to go to the closet. He may or may not pass any faecal matter, but does pass a thin sanious discharge, having a most characteristic odor. Later the bowels move several times during the morning and most of the stools consist of this sanious discharge. The color of the stools is such that most patients ascribe their trouble to piles, and the discharge is attributed to blood from the latter. Constipation may alternate with the attacks of diarrhœa.

Pain is nearly always a very late symptom of cancer of the bowel; this depends, however, upon the rapidity of the growth of the neoplasm. As soon as the growth invades the anal portion, or neighboring organs or involves the sacral nerves, pain becomes a marked factor. Obstruction

of the bowel and the straining efforts at defecation will tend to increase the pain.

The discharge varies in quantity in different cases and at various stages of the development of the growth. In the early stages the blood is probably brighter in color and is derived from the congested vessels in the neighborhood of the tumor, but later on the hæmorrhage is due to ulceration and erosion, as well as to congestion. In some cases the constitutional effects are most marked. In nearly all cases there is loss of flesh and strength. Sometimes the cancerous cachexia is not sufficiently marked as to be very noticeable. In the late stages the liver is often enlarged. The lumbar and pelvic glands are usually involved, although this condition may not be so marked as to be readily distinguishable.

The duration of the symptoms varies in different cases and depends, to some extent, upon the age of the patient and the character of the neoplasm. In the young the disease generally runs its course quite rapidly, and when the growth is soft its effects are more rapid.

**Diagnosis.**—There are two conditions which are likely to be confounded with malignant disease of the rectum, one being benign growths and the other neoplasms external to the bowel.

**BENIGN GROWTHS** are generally pedunculated; cancers rarely so; benign growths, unless ulcerated, are bathed in healthy, transparent mucus; cancers discharge offensive, chocolate-colored matter, the odor of the same being almost pathognomonic of malignant disease. Benign tumors are not friable, like malignant growths, nor do they bleed as easily. Benign neoplasms spring from a soft, healthy mucous membrane, which glides freely upon the deeper coats of the bowel, while the malignant tumor grows from an indurated lump or patch in the

bowel, which seems fixed or rigid. In suspected tumors, in which the diagnosis is at all obscured, a small specimen of the same may be obtained by scraping the tumor either with the finger-nail or a curette, and subjecting the excised portions to a microscopical examination (Andrews, *op. cit.*, pp. 112-13).

**Prognosis.**—The duration of the symptoms will prove of value in reaching a conclusion; the onset and progress of benign neoplasms being extremely slow. In malignant disease there is usually a portion of tolerably healthy mucous membrane between the growth and the anus, whereas in the non-malignant stricture this portion of the bowel is generally more or less infiltrated (Harrison Cripps, *op. cit.*, p. 383).

**Etiology.**—The causes of this disease are not known, and even its pathology is subject to dispute. The question of heredity is an open one, and probably if it be a factor it is one of only slight importance. Climate, as noted by the Messrs. Andrews, influences the tendency to cancer. These authorities state that it is clear that in this country cancer prevails most near the sea, and least of all at a distance from it; also, that, at equal distances from the sea, it abounds decidedly more at the North than at the South. The germ theory, as applied to the origin of this disease, has some ardent advocates, but so far success in proving this to be more than a theory has not crowned the efforts of the microscopists.

**Treatment.**—The surgical treatment of this disease will first engage our attention because it is to such procedures that we must look to for the most relief. If it were possible to recognize the existence of cancer at its earliest stages and to obtain consent for its radical removal, the prognosis of such operations would be greatly bettered and the statistics would



show, at least, a remarkable prolongation of life. Great relief from its most distressing symptoms would also be afforded.

It is frequently a hard matter to decide which of the surgical procedures is to be resorted to, the aim being to afford the greatest relief with the incurrence of the minimum risk. The recognized procedures are four in number: *extirpation*; *colostomy*, inguinal and lumbar; *posterior linear proctotomy*; and *curettage*.

**EXTIRPATION.**—The ideal method of treating cancer of the rectum would be by extirpation, as is done in cases of the same disease when the mammary gland is the site affected; but unfortunately it is not often that the rectal neoplasm is discovered in time to permit the entire removal of the growth and of all glandular involvement; consequently, it is my belief that the cases in which this operation is indicated will be confined to a relatively small number of cases.

Kraske, of Freiburg, recommends a radical operation for the excision of the rectum. Up to 1897 (Sammlung klin. Vort., 183-184, '97) he had operated upon 80 cases, 15 of which died. The 80 cases divided into two series, the first of which occupies five years, during which writer was perfecting the operation; it comprises 29 cases with 10 deaths, giving a mortality of 34.5 per cent. The second series, extending over the last 7 years, includes 51 cases with only 5 deaths, being a mortality of 9.8 per cent.

The operation is as follows: The patient being placed on his left side, an incision is made starting from the second piece of the sacrum and extending down to the anus, in the middle line. The soft tissues are then carefully raised from the sacrum, the coccyx is excised, and the sacro-sciatic ligaments are severed at the sacrum. The rectum is thus brought

into the field of operation. If it is necessary to increase the field a portion of the left side of the sacrum opposite the third sacral foramen may be removed. Kraske does not favor sacral section above this level, nor does he recognize the utility of a temporary or osteoplastic resection, which some advocate with a view to prevent prolapse of the pelvic organs, owing to a presumed weakening of the floor of the pelvis. The resection of the cancer is begun by him with the division of the bowel below the tumor by opening it transversely; sutures are then placed in the upper cut surface for traction purposes. The patient is then brought into the lithotomy position, and the dissection proceeded with. Sometimes the peritoneum can be peeled off the bowel; but, if necessary, it must be opened, two fingers introduced, the gut pulled down, and the operation proceeded with. Packing of the wound with iodoform gauze should be adopted to prevent infection, and need not be removed till it shows a tendency to become loose, about the end of the first week.

Seventeen cases of amputation of the rectum by Kraske's method: 3 of the patients died, giving a mortality of 17.07 per cent. Of the 14 cases traced, 6 have now passed beyond the three-year limit and may be considered reasonably safe from recurrence. Two of the men, in spite of the loss of the coccyx and part of the sacrum, ride bicycles with ease. W. W. Keen (Jour. Amer. Med. Assoc., Aug. 13, '98).

J. M. Mathews (N. C. Med. Jour., Apr. 20, '98) states that unless all tissues involved in the cancerous disease can be removed, an operation is useless. The rectum is contiguous to a large distribution of glands and lymphatics. Cancer situated above and not involving the sphincter-muscle is often an insidious disease. When the mass has so far extended as to embrace the whole rectum,

it is safe to infer that the infiltrative process has so extended that it has embraced structures which cannot be removed; hence to resect simply the mass in sight would avail nothing. If, on the contrary, the growth can be circumscribed, and the assurance had that all diseased structures can be removed, then resection, or rather extirpation, should be advised. Operation is much more preferable than to perform a colostomy in such a case. The latter can only be a palliative, if that; while the former anticipates a radical cure. Mathews avoids such operations as Kraske's if a lesser one will accomplish the purpose. Removing portions of the rectum by the simple circular incision and a careful dissection of the gut with the fingers has been practiced by him.

There are many cases on record in which there was prolonged life after rectal excision, and many cases have been recorded of non-recurrence for six, eight, and ten years. The mortality of rectal excision by sacral operation varies from 20 per cent. to 25 per cent. Czerny's mortality was 5.4 per cent. by the perineal route, 19.4 per cent. by the sacral route; Iversen, 25 per cent.; Albert, 18 per cent.; Ball, 8 per cent.; and Paul, 14 per cent. E. H. Taylor (*Annals of Surg.*, Apr., '97).

The main objections to the operations of the past are ineffectual removal with local recurrence so common in the perineal type; the extensive mutilating character of the Kraske before operative conditions were known; the frequent failure of all methods of union of proximal and distal portions of the bowel which, when united and anus saved, with the destruction of the levator and internal sphincter, represented but one-third of the controlling apparatus of the bowel; the frequent formation of stricture either cicatricial or cancerous following operation, necessitating inguinal colostomy; the straightening and tension of the sigmoid destroyed it as a faecal container. Sentiment and not chance has proven the

main reason for continuing to place an uncontrollable anus in a comparatively inaccessible situation. The combined intraperitoneal and perineal method permits the surgeon to suit the procedure to the individual case. He can either radically remove the tumor and glands, or he may simply do a colostomy. When total removal is performed, the proximal portion of the bowel, which is the sigmoid, can be brought out of the abdomen in the left iliac fossa through the gridiron opening of McBurney, which gives a fair control of the bowel and does not destroy the function of the sigmoid as a faecal container. C. H. Mayo (*Journal American Medical Association*, April 25, 1903).

**COLOSTOMY.**—Colostomy is quite practicable in a large number of instances, and the benefits derived from its performance are thus minutely described by Charles B. Kelsey (*N. Y. Med. Jour.*, Nov., '92): "It relieves pain: does away with the constant tenesmus and discharge from the rectum, which by their exhausting effects are the immediate cause of death; delays the development of the disease by preventing the straining and congestion of defecation; prevents absolutely the complication of intestinal obstruction, which is another cause of death; enables the patient to sleep, eat, and gain flesh, and often makes him think himself cured in spite of the plainest prognosis to the contrary. Instead of his passing his days and nights upon the commode, wearing out his life in his efforts to free the bowel from its irritation, he has one or perhaps two solid faecal evacuations from the groin in twenty-four hours." The benefits to be derived from colostomy are not exaggerated. It is the operative procedure indicated when a cancer has reached the stage of operative interference and has passed beyond the time when the surgeon reasonably expects an extirpation to afford a radical cure.



POSTERIOR LINEAR PROCTOTOMY.—I have never attempted to relieve a patient suffering from malignant trouble by means of this operation. In benign structures I have found the procedure a most excellent plan of treatment when combined with the subsequent use of bougies. Those surgeons who adopt this method for the relief of cancer speak highly of its efficiency, some going so far as to claim that it takes the place of both colostomy and excision.

Resection of the rectum *per vaginam* successfully performed in five cases. The patient being placed in the lithotomy position, the vagina is dilated. The cervix is drawn down and Douglas's pouch opened by a transverse incision, the intestines being pressed back with flat sponges. The recto-vaginal septum is divided down to the rectal wall by a vertical incision in the middle line, extending from the post-cervical opening and including the sphincter ani. The hæmorrhage can be controlled by forceps and compresses. The posterior vaginal wall is now dissected off the rectum; lateral and anterior retractors may now be used, exposing a large operation site. The sigmoid can now be easily drawn down. The anterior rectal wall, including the sphincter, is divided up to the lower border of the tumor, and the anal segment of the rectum separated by a complete transverse incision an inch below the lower limit of the tumor. The proximal end of the rectum is grasped by a volsella, and separated by curved scissors from its coccygeal and sacral attachments up to the promontory. The mesosigmoid is loosened sufficiently to allow a healthy portion of bowel to be drawn well down. The rectum is amputated above the upper border of the tumor; then the sigmoid and sphincter segments are united end to end by silk sutures, passed from within outward. The incision in the anterior rectal wall is also closed by silk sutures, and the ends of the divided sphincter are united by buried catgut sutures. The sponges are now removed, and the peritoneum closed by a continu-

ous catgut suture. The vaginal wall is now sutured with silk-worm gut. A rubber drainage-tube, 1 inch in diameter, is now placed in the rectum.

The advantages of the vaginal route are:—

The sacrum and posterior bony wall of the pelvis are not disturbed.

The field of operation is as extensive and the anatomical parts as accessible as in the transsacral operations.

The peritoneal cavity is opened in both the vaginal and sacral operations, and in neither is it a source of great danger.

The diseased tissue is more accessible for inspection, and the extent to which the operation may be carried in an upward direction is as great, if not greater, than by the sacral route.

The peritoneum may be drained freely through the vagina.

A perfect end-to-end approximation, either by suture or by the use of the button, may be secured. The preferable method of uniting the two ends is by interrupted sutures of silk, because as there is no peritoneum on the sphincteric segment, failure of union with the button is to be feared.

The sphincter is retained and the perineal body is restored. There is diminished action of the levator ani muscle.

When the operation is complete the parts are practically in their normal positions. J. B. Murphy (Phila. Med. Jour., Feb. 23, 1901).

CURETTAGE.—In those cases in which the growth is within the lower three inches of the rectum and its character is such that extirpation is not possible and colostomy is not at the time necessary and the growth not hard, considerable temporary benefit may be given the patient by resorting to this operation. In selected cases it is followed by a diminution of pain, bearing-down sensations, and discharge, and the lumen of the bowel is enlarged.

In certain cases the combined operations of colostomy and of curettage will afford the patient much more relief than

where one or the other procedure is individually adopted. It is true that only temporary relief is afforded by either of these operations, but in the majority of cases this is all we can offer the patient under any plan of treatment in vogue at the present time.

The *medical treatment* of cancer of the rectum presents but three points for consideration: the daily evacuation of the bowels, the use of some soothing local antiseptic wash to cleanse the parts, and the relief of pain and tenesmus. The first indication may be met by the employment of salines: citrate of magnesia, Epsom salt, or phosphate of sodium. The second by enemata of a 2-per-cent. solution of creolin, or the same strength solution of permanganate of potassium. The third indication for a time may be overcome by the use of iodoform suppositories (10 grains of the drug in each suppository used, if necessary, every six hours). The use of opium should be avoided as long as possible. The denarcotized tincture of opium is the best preparation to employ.

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Philadelphia.

**TURPENTINE.** — Turpentine (crude, or white, turpentine; common frankincense; terebinthina, U. S. P.) is a concrete oleoresin obtained from *Pinus palustris* and from other specimens of *Pinus* (nat. ord., *Coniferae*). From this crude turpentine a volatile oil may be distilled officially known as oleum terebinthinæ (U. S. P.), from which are prepared linimentum terebinthinæ (U. S. P.) and oleum terebinthinæ rectificatum (U. S. P.). Turpentine-oil is a solvent for wax, iodine, sulphur, phosphorus, and the fixed oils. Rectified turpentine is obtained by redistilling the oil of turpentine. It is alone suited for internal uses. When the oil of turpentine is distilled off

from turpentine a resin (rosin) is left which is official (resina, U. S. P.) and from which are prepared ceratum resinæ (U. S. P.) and emplastrum resinæ (U. S. P.).

**TEREBINTHINA CANADENSIS**, U. S. P. (Canada turpentine; Canada balsam; balsam of fir) is the natural oleoresin from the balm-of-Gilead fir (*Abies balsamea*). It occurs as a yellowish, transparent, viscid liquid having an agreeable, pine-like odor and a bitter taste, and soluble in ether, chloroform, benzin, xylol, turpentine, oils, etc.

**TEREBENE** (terebenum, U. S. P.) is obtained by subjecting oil of turpentine to the action of sulphuric acid and distilling at a temperature of 160° F. It occurs as a clear, colorless, or slightly yellowish, mobile liquid, having a fresh-pine odor and a pungent taste, freely soluble in water, ether, glacial acetic acid, and carbon disulphide.

**TERPIN HYDRATE** (terpini hydras, U. S. P.; dipentene-glycol) is the hydrate of the distomic alcohol terpin. It occurs in colorless, lustrous, rhombic prisms, having a slightly-bitter taste, and soluble in benzene (benzol), in 10 parts of cold and in 2 parts of boiling alcohol, in 100 parts of ether, in 200 parts of chloroform, in 250 parts of cold and in 32 parts of boiling water, in equal parts of glacial acetic acid, and in carbon disulphide.

**Preparations and Doses.** — Terebinthina (U. S. P.), 5 to 30 minims.

Terebinthina Canadensis (U. S. P.), 5 to 30 minims.

Linimentum terebinthinæ, U. S. P. (resin cerati, 65 parts; oil of turpentine, 35 parts). Used externally.

Oleum terebinthinæ (U. S. P.), 5 to 30 minims (as anthelmintic, 1½ ounce).

Terebenum (U. S. P.), 3 to 15 minims.

Terpini hydras (U. S. P.), 2 to 10 grains.



**Physiological Action.**—The oil of turpentine, taken internally in moderate doses, gives rise to a sensation of warmth in the stomach. The circulation is quickened and the warmth of the skin is increased; no cerebral stimulation appears, although vertigo and intoxication may come on if the dose be large enough. Small doses frequently repeated stimulate the kidneys; if long continued, irritation of the genito-urinary tract ensues which may result in strangury. The urine acquires the odor of violets, and may contain blood. Turpentine is excreted by the lungs and the kidneys, even when taken by inhalation. An erythematous eruption occasionally appears after the ingestion of turpentine. The coagulability of the blood is increased by the administration of this drug.

**Poisoning by Turpentine.**—Although turpentine is capable of producing death, cases of serious poisoning by it are rare, and a fatal case is exceedingly so. Most of the symptoms are constant, except vomiting and purging, which are present in some cases and not in others. There is generally complete unconsciousness, which is occasionally accompanied by dilated pupils; the urine, often bloody, is very much lessened in quantity and frequently suppressed; the skin is sometimes dry, sometimes moist; the pulse is feeble, rapid, and generally regular. The lethal dose is not definitely known, but must be very large. Toxic doses of turpentine paralyze the sensory nervous system, either in the cord or in the peripheral nerves, and death results from respiratory paralysis.

The treatment of poisoning by turpentine consists in the evacuation of the stomach and bowels by liberal doses of magnesium sulphate, the administration of demulcent drinks to soothe the irritated mucous membrane of the aliment-

ary canal, and the exhibition of morphine in sufficient doses to control peristalsis, cystic spasm, and pain.

**Therapeutics.**—Turpentine is a valuable local application for the purpose of producing counter-irritation over the surface when deep-seated inflammation exists. For this purpose it may be used in the form of a stupe, or diluted with equal parts of olive-oil or cotton-seed oil.

Turpentine is used internally as a diffusible stimulant in exhausting fevers, especially if flatulence or ulceration be present.

In typhoid fever it is useful to overcome tympanites administered internally or as stupe or enema. It is also valuable in the same disease toward the end of the second week when the tongue is red, cracked, and brown, the teeth covered with sordes, and well marked tympany is present, 5 to 10 drops given in emulsion three times a day being usually sufficient. It is again useful during the stage of convalescence from typhoid, when persistent diarrhoea and constant relapses result from an unhealed condition of Peyer's patches.

Turpentine is often of service in intestinal and other passive hæmorrhages, such as hæmaturia and menorrhagia.

Turpentine is useful as an hæmostatic and also as a stimulant alterative in subacute and chronic catarrh of the gastro-intestinal system. In hæmatemesis from chronic alcoholism or chronic venous engorgement from other causes it is more efficient than the astringents. The best method of administration is in suspension. Two to 10 drops of turpentine may be stirred into an ounce or two of water, well sweetened with the saccharum anisi of the German Pharmacopœia. Where the stomach is non-retentive, small doses every two hours may be given. In catarrhs of the respiratory system after the subsidence of acute symptoms, where a free secretion is present, or where the catarrh persists with

or without localized subcrepitant râles, its value is exceptional. In more chronic cases it is often equally efficacious and less objectionable than guaiacol or creasote. It is invaluable also in the bronchial catarrhs of the aged and the infirm. In the catarrhal conditions of phthisis, especially when bronchorrhœa is present, it is equal, if not superior, to guaiacol and creasote, while in the hæmorrhages of phthisis it should hold first rank. In hæmaturia, as in other mucous hæmorrhages, it has a great hæmostatic virtue. In metrorrhagia without tumor or other palpable cause it is of great service. J. B. Walker (Ther. Gaz., July 15, '97).

Turpentine is an efficient, though somewhat dangerous, remedy against tape-worm in the dose of  $\frac{1}{2}$  to 1 ounce mixed with an equal quantity of castor-oil.

In chronic and well-advanced renal disease, turpentine may be used when very large doses of powerful diuretics are required to excite the secretion of urine.

A dose of 20 drops is said to be useful in lumbago.

The vapor of turpentine when inhaled from boiling water is valuable in bronchitis. In gleet it is sometimes used to stimulate the genito-urinary tract. Turpentine is an efficient remedy in some cases of purpura hæmorrhagica.

Turpentine is contra-indicated in any acute inflammation of the gastro-intestinal tract and in acute nephritis.

## TYPHOID FEVER.

**Definition.**—Typhoid fever is an acute contagious self-limited disease, which is characterized by inflammation and ulceration of Peyer's patches and the solitary glands of the small and large intestine. Although these lesions are present in such a large number of cases that the term "enteric fever" has been widely used in designating the disease, it must be remembered that fatal cases

occur in which the intestines are quite normal and the lesions are found in other parts of the body.

**Varieties.**—1. The *abortive* form, in which the temperature, after eight or ten days, falls to normal. The hyperplasia of Peyer's patches is not followed by necrosis and ulceration, but resolution takes place at once.

2. The *mild* type, in which the temperature reaches its maximum by the end of the second and becomes normal during the third week. The disease runs an uncomplicated course and the abdominal symptoms are not severe.

3. The *severe* form, in which the patient during the second or third week passes into a low adynamic condition.

4. The *hæmorrhagic* form, in which there is a tendency to extravasation of blood in different parts of the body.

5. The *renal* and (6) the *pneumonic* varieties, in which the kidney and lungs are early and extensively diseased.

7. The *ambulatory* cases in which the patient continues to go about notwithstanding the presence of the disease.

8. The typhoid fever of *children*, in which the temperature-curve does not present the gradual rise and fall of typical cases, the abdominal symptoms are not so marked as in the disease of adults, and in which bronchitis and nervous symptoms are especially prominent.

9. The typhoid fever of *old age*, in which the disease runs a severe and often fatal course and in which pneumonia is a frequent complication.

10. The typhoid fever of *pregnancy*, which usually occurs in the first four months and frequently produces abortion or premature delivery.

**Symptoms.**—The stage of incubation varies much in duration, and is generally considered to be two or three weeks. It is sometimes much shorter. Wilson men-



tions a case in which the disease appeared four days after exposure.

The onset is, as a general rule, slow and gradual. The patient complains of a general feeling of weariness, of loss of appetite, slight nausea, and sometimes of diarrhoea, which is increased by mild cathartics. Headaches, usually frontal, which become more intense toward evening, as well as pains in the back and limbs, are frequently experienced. Chills, more or less severe, are often present and they are sometimes followed by sweats. The countenance is dull, there is slight nose-bleeding, and the tongue is coated with a white fur. The symptoms come on so gradually in many cases that the patient does not consult a physician until the disease is well established, and the temperature is found as high as  $102^{\circ}$  or  $103^{\circ}$ . On the other hand, the onset is sometimes sudden and the temperature rises rapidly.

In some cases the headache is so severe and continuous that the case is mistaken for one of meningitis. The pain causes the greatest suffering and distress, and anodynes require to be administered for its relief. Pain in the back of the neck is occasionally severe and accompanied by local tenderness. This leads to the diagnosis of cerebro-spinal meningitis. The differentiation sometimes cannot be easily made for the first few days. In rare cases lethargy is a very pronounced symptom.

Delirium is sometimes a marked symptom at the onset. A patient once came to my consulting-room for the first time when in a state of delirium.

In cases of pneumonic typhoid the onset may be very similar to that of a pneumonia, and the typhoid character of the case may not become manifest until after eight or ten days, when the fever does not terminate by crisis, but

continues on in the ordinary course of typhoid.

Bronchitis, especially in children, is sometimes severe at the onset. The continued elevation of temperature will lead the medical attendant to a correct diagnosis. In a few cases the disease begins as an acute nephritis, and the symptoms of the latter may be so severe as to altogether obscure the real disease.

Although, in the great majority of cases, the temperature rises gradually, it may reach  $102^{\circ}$  or  $103^{\circ}$  on the second day.

It is difficult to fix definitely the actual period of onset. Flint considered the time when the patient took to bed as the commencement of the disease. This is a good rule. In the general description it is necessary to divide the time into periods of weeks.

*First Week.*—In a moderately-severe case the patient, after complaining for a few days of the symptoms already mentioned, becomes so weak that he finds his bed the most comfortable place, or more frequently he consults a physician, who, suspecting the nature of the disease, sends him to bed.

The patient may suffer from severe headache, pains in the back of the neck, in the small of the back, and in the extremities. Wakefulness is sometimes a distressing symptom. As a general rule, delirium is absent during the first week. The patient is usually dull and apathetic, but sometimes the intellect is so clear that the attending physician is thrown off his guard. The skin is hot and dry, and, in some cases, an erythematous rash appears, widely spread over the surface of the body.

Toward the end of the week a few rose-colored spots appear, usually over the abdomen, but occasionally on other parts of the body. There are not more than

twenty or thirty present in most cases, but occasionally they occur in large numbers over different parts of the body. The patient complains of a slight cough; and, on examination of the chest, a few bronchitic râles are found. The tongue becomes coated with a white fur, which does not extend quite to the margin or tip. Nausea and want of appetite are present, but usually the patient takes fluids without repugnance. In some cases there is decided irritability of the stomach. More or less diarrhœa is usually present, but the opposite condition of constipation may prevail. The spleen becomes enlarged toward the end of the week.

The pulse is increased in frequency, but not in proportion to the temperature. It is soft, compressible, and often dicrotic.

The temperature gradually rises a part of a degree each day. The evening temperature is higher than that of the morning. The general rise continues until the end of the week.

*Second Week.*—During the second week the symptoms already described increase in severity. The patient loses strength from day to day until he is no longer able to help himself. Dullness and apathy increase, and deafness becomes more marked. The countenance is flushed and may become expressionless. The headache gradually disappears and delirium supervenes. In severe cases coma vigil, carphologia, and subsultus tendinum may be present at the end of the second week, and death may follow. Successive crops of spots appear on the chest and abdomen. The tongue continues coated, or it may become dry, red, and cracked. The stomach is often less irritable than during the first week. The abdomen becomes tympanitic, and tenderness, with gurgling, is noticed in

the right iliac fossa. Diarrhœa, with ochre-colored stools, is present in the majority of cases. Hæmorrhage may occur toward the end of the week. The pulse becomes more rapid and the temperature maintains the elevation of the end of the first week, or may ascend still farther. It presents daily variations. The heart's action becomes more feeble; so that in some cases the first sound is scarcely heard. Symptoms of pulmonary congestion may appear.

*Third Week.*—In the severe cases the patient's weakness and emaciation become intense and the muscular movements are made with difficulty. Subsultus tendinum may be quite marked. Delirium continues and that peculiar condition of wakefulness, coma vigil, may be pronounced. The emaciation, flushed condition of the cheeks, and the eyes wide open form a very characteristic type of countenance.

Frequent perspirations occur, which are followed by eruption of sudamina. The rose-colored spots continue to appear in successive crops. Diarrhœa is often severe. Hæmorrhage and perforation may occur during this week.

The pulse becomes more rapid and feeble and the first sound of the heart may be scarcely audible. The temperature in the milder forms may gradually fall to normal in the third week, but, in severe cases, it continues as high as during the second week, presenting, often, marked remissions.

*Fourth Week.*—During this period, as a general rule, convalescence becomes well established and there is a gradual abatement of the symptoms already described. In severe cases the disease may continue throughout the fourth and even the fifth weeks in the same way as in the third, except that the adynamia and emaciation are increased. The urine and



fæces may be passed involuntarily. The pulse becomes more rapid and weak, "the running pulse," and death takes place from heart-failure, asthenia, hæmorrhage, or perforation. The temperature can be irregular, and may rise from slight causes. Perspirations continue even in the more favorable cases.

The disease may continue through the fifth and sixth weeks.

*The Digestive System.* — The tongue presents a characteristic appearance. When protruded, tremulousness is observed; and, in the latter stages of severe cases, hesitation; and the patient, apparently from forgetfulness, does not withdraw it. The surface during the first part of the disease is covered with a white fur, thick in the centre and disappearing toward the tip and edges. It is made up of micro-organisms, degenerated epithelial cells, and particles of food. At the end of the second and during the third and fourth weeks the surface may become bare, red, and dry. It sometimes presents a glazed appearance, and is more or less cracked, or it may be covered with a brownish-black coating. This may result from breathing through the mouth, and is an indication of the severity of the disease. The gums and tongue often bleed, and the accumulation of blood, retained food, and epithelial cells around the teeth and lips form what is known as sordes. When convalescence becomes established the tongue gradually assumes its normal appearance, but the coating returns if there is any rise of temperature or impairment of digestion.

The lips become dry, hard, and cracked, and the mouth often contains a sticky mucus. The chewing of hard substances is often impossible, and even drinking is made difficult.

Anorexia and nausea are, as a rule, present, but occasionally the appetite is

maintained throughout the whole course of the disease. The stomach will tolerate liquid food except in some cases in which there is great gastric irritability, and this is usually more pronounced during the first week. Sometimes this irritability continues and the patient succumbs for want of sufficient nourishment. Ulceration of the stomach very rarely occurs in typhoid, and perforation from this cause has been reported.

Thirst is a prominent symptom, and liquids will often be taken with avidity when, owing to the mental condition of the patient, they are not asked for.

More or less diarrhœa in some stages of the disease is the rule, but constipation may be present throughout, and this may be the case when extensive ulceration of Peyer's patches is present. Hiccough is sometimes a troublesome symptom, and is often hard to control.

The number of evacuations in the diarrhœal cases may be from 5 or 6 to 20 or 25 daily. They are copious: liquid, with solid particles (pea-soup character); of a yellow-ochre color, with offensive odor. When allowed to stand, the solid matter settles to the bottom, leaving a clear fluid on top. The former is composed of undigested food, shreds of mucous membrane, epithelial cells, mucous corpuscles, and crystals of tribasic phosphate.

The bacillus typhosus is not usually found in the intestinal discharges until after the tenth day. About the commencement of the third week these organisms exist in large numbers, and recent investigations have demonstrated the fact that the fæces may contain typhoid bacilli some weeks after convalescence has been established.

Typhoid bacilli are present in the stools in the third week of the disease; from this time they rapidly diminish and soon disappear. If a relapse occurs, there

is a reappearance of the organism in the stools. Those cases in which the bacilli are found in the stools long after the disappearance of the fever are cases where the bowel discharges were mixed with urine. In about 25 per cent. of all cases the typhoid bacilli are found in the urine. They rarely appear before the third week of the disease, and sometimes persist long after convalescence is established. Therefore the urine is a much more dangerous excretion for the dissemination of typhoid fever than are the stools. P. H. Smith (Lancet, May 20, '99).

Typhoid bacilli occur in the blood with much greater frequency and during a much longer time through the course of the disease than was formerly supposed. The conditions which favor their presence, why they are found at times in mild cases and are absent in more severe ones, are questions which must yet be solved. That cultures from the blood in typhoid fever have very definite clinical importance, especially where the Widal reaction is delayed, as is so often the case, is evident. From personal experience, the use of considerable amounts of blood, diluting very largely in liquid media, and, on account of the use of the latter, especial care to avoid contamination are the points of chief importance. R. I. Cole (Johns Hopkins Hosp. Bull., July, 1901).

Sometimes, when there is extreme weakness in the latter stages of the disease, hard masses may form in the rectum of a chalky appearance, the evacuation of which causes great exhaustion. Sometimes assistance is necessary to their removal.

Hæmorrhage from the bowels occurred in from 3 to 5 per cent. of all cases collected by Flint, and in 99 out of 2000 cases observed in Munich. It usually occurs at the end of the second or during the third week. It is a serious, but not necessarily fatal, symptom. About two-thirds of the cases terminate favorably.

According to Wilson, modern statistics

give a mortality of from 30 to 50 per cent. in which the patients die either from exhaustion or from subsequent perforation and peritonitis. In some cases the hæmorrhage is, for a few days, slight in amount, and then the blood may be poured out in large quantities. In others, again, a severe hæmorrhage may come on suddenly and unexpectedly. Sometimes small quantities of blood may be evacuated daily without the occurrence of any great loss. A severe and even fatal hæmorrhage may take place after the disappearance of the fever, apparently from the breaking down of the cicatricial tissue.

The general symptoms of hæmorrhage are fall in temperature, increased rapidity and weakness of the pulse, and a cold and clammy condition of the skin.

In some cases the symptoms are present some time before the blood is evacuated.

In addition to the symptoms already mentioned, delirium ceases and consciousness may be regained after the loss of a large quantity of blood. Faintness and extreme prostration precede a fatal result.

In cases which rally the temperature rises and the symptoms of collapse gradually disappear. A diagnosis of concealed hæmorrhage is made by noting the symptoms already described and by making a careful physical examination of the abdomen. Dullness on percussion, with a feeling of more or less resistance, will be found in some cases over the right iliac region and sometimes extends along the ascending colon. Intestinal hæmorrhage may be part of a general condition, and ulceration into a vessel may have taken place.

*Tympanites.*—Greater or less swelling of the abdomen from the accumulation of gas is usually present. It does not, as



a rule, give rise to grave symptoms. Meteorism arises from two principal causes: the increased fermentation which takes place in the intestinal contents and the paralysis of the muscular coat resulting from toxæmia. The presence of a large quantity of gas depresses the heart's action and favors the occurrence of perforation and hæmorrhage. Meteorism is, no doubt, increased in some cases by the administration of too much food.

Pain is present in a small number of cases. Intestinal ulceration and subsequent peritonitis may give rise to very severe pain. Tenderness on pressure in the right iliac fossa is frequently noticed. It may be most marked near the umbilicus and is occasionally found over the whole surface of the abdomen. The amount of tenderness is apt to be greater in nervous patients. Gurgling from pressure over the right iliac fossa is often present, but is found in many other conditions as well as in typhoid fever.

*Perforation and Peritonitis.*—The ulceration of Peyer's patches, which usually extends to the muscular coat, is sometimes continued through the peritoneum. An opening is made through which the gas, liquid, and solid contents of the intestine pass out into the peritoneal cavity. The patient is usually seized with sudden and severe pain in the umbilical region, which subsides only after the administration of morphine.

Study of pain as a symptom in 500 cases. About two-fifths of the patients are free from pain or tenderness, rather less than one-fifth have tenderness only, and pain is present at some time in about two-fifths of the cases, but during the course only in about one-third.

Pain due to some condition other than the specific bowel-lesions was present in about 14 per cent. of all cases and in about two-fifths of the patients having pain during the course. It occurred with hæmorrhage or perforation in

about 5 per cent. of all cases, and in about 15 per cent. of the cases in which there was pain during the course. It was most constantly present with perforation, when it was usually sudden in onset, severe in character, and paroxysmal in occurrence. The pain of perforation was most closely simulated by that occurring in some cases of hæmorrhage, that from phlebitis, and that of unknown origin. In about two-fifths of all cases with pain during the course no cause could be found. Should this occur with other abdominal symptoms the condition may much resemble perforation. Thomas McCrae (N. Y. Med. Jour., May 4, 1901).

Vomiting is a frequent symptom. The abdomen may first be flat and rigid, but soon swelling, with meteorism, supervenes. The temperature usually falls below normal, and the patient becomes collapsed. The breathing is rapid, the pulse feeble and frequent, and there is partial suppression of urine. A peculiar pinched expression of countenance, sunken eyes, and cold, clammy surface of skin are often present. In some cases the pain is not severe and the symptoms of collapse are but slightly marked.

[Perforation occurred in 34 of Osler's 685 cases (2.48 per cent.), and in 4680 cases tabulated by Fitz perforation took place in 6.58 per cent. It is more frequent in men than in women. J. E. GRAHAM.]

Study of 24 cases of peritoneal infection in typhoid fever. Abdominal pain in any typhoid case should be regarded as a serious danger-signal. It is most frequent in the right iliac region, and often associated with localized tenderness and muscular spasm. The suspicion of beginning peritoneal infection is confirmed by a rising leucocyte-count; examinations should be made at hourly intervals. Vomiting is rare, and an increase in pain is generally accompanied by a rise in temperature and quickened pulse-rate. G. B. Shattuck, J. C. Warren, and Farrar Cobb (Boston Med. and Surg. Jour., June 28, 1900).

The importance of an early diagnosis is increased on account of the success of surgical operation when performed shortly after the occurrence of the perforation. The absence of liver-dullness is often an important sign demonstrating the fact that gas exists in the peritoneal cavity. It must be remembered, however, that extreme distension of the bowels may push the liver upward and backward to such an extent as to cause hepatic dullness to disappear in front. In such cases the dullness will be made out by percussion of the back to a greater extent than when gas exists in the peritoneal cavity. Hæmorrhage may accompany perforation.

The early diagnosis in perforation may be confirmed in some cases by a careful blood-count, when the number of leucocytes will be found increased. This is not always the case; perforation may be followed by leucocytosis; and, on the other hand, an increased leucocytosis may be present without perforation.

Peritonitis may occur without perforation. Inflammation and rupture of a mesenteric gland are sometimes the cause, and it may be caused directly by the presence of typhoid bacilli in the abdominal cavity.

Death may follow from collapse shortly after a perforation or the patient may rally and suffer from peritonitis. The latter is diagnosed by the presence of pain and tenderness of the abdomen, and pinched expression of countenance, with rapid and feeble pulse. Death occurs on the third or fourth day after the attack. Recovery very rarely takes place.

*The Spleen.*—Enlargement of the spleen is present, according to Leube, in 90 per cent. of all cases, and Osler is of the opinion that it occurs in all cases. The enlargement continues until the fourth week, when it gradually disap-

pears. The normal area of splenic dullness which extends in the midaxillary line from the ninth to the eleventh ribs may be increased upward and downward. The lower edge may often be felt under the costal margin upon deep inspiration. The enlargement is rarely accompanied by pain. Rupture has taken place spontaneously as well as from the result of a blow.

*The Liver.*—Jaundice is not a frequent symptom in typhoid fever. It results from toxæmia, abscess, or gall-stones.

The urine usually in jaundiced cases contains bile-pigment, albumin, and casts. The stools are not clay colored, but are dark and of the typhoid character. Epistaxis is frequent, and is severe in proportion to the severity of the jaundice.

*Nervous System.*—In mild cases and sometimes when the disease is severe, the patient remains conscious throughout, and there is little to be noted in connection with the nervous system. Headache is nearly always present in the early part of the disease. The pain may be felt over the whole head, in the occipital or frontal region, most frequently in the latter situation. It is usually dull, but occasionally may be so severe as to closely resemble that of meningitis.

The headache usually subsides about the end of the first or beginning of the second week. Pain in the back of the neck is sometimes severe, and continues four or five days.

Pains in the back and limbs, varying in intensity, are experienced in a large proportion of cases. Painful sensations and hyperæsthesia in the feet are often noticed. Neuralgia, especially of the trigeminal nerve, occurs in some cases.

Delirium is one of the most frequent nervous symptoms. Its severity is not always in proportion to the severity of



the disease, but depends, to some extent, on the individual. When, however, the delirium is active and uncontrollable, the prognosis is usually grave. It does not generally begin until the middle of the second week and ceases in the stage of convalescence. Sometimes it occurs only in the night, or for a few hours after waking, but it is usually continuous. In rare cases it is one of the earliest symptoms, and it occasionally lasts for three or four weeks after defervescence. The delirium is generally of a low, muttering character. The patient will try to get out of bed, but is easily induced to return. Sometimes the delirium is active and almost maniacal. A suicidal mania may develop, and, on that account, as well as to prevent injury, a patient in typhoid delirium should never be left alone. In some rare instances the same delusions are noticed from day to day throughout the disease. The writer had once a case in which the delusions of grandeur were manifested continuously. The patient was extremely happy, paying out enormous sums of money and making handsome presents to all his friends.

In many cases where delirium is not present the patient will answer questions in a rather incoherent manner, and even when nothing can be noticed which would indicate mental aberration. He will not afterward remember anything which has occurred during the course of the disease.

In a few cases the delirium is of an hysterical character, and the differentiation between it and hysterical mania is made by the comparatively-mild type of the former.

In the third week, when the disease is severe, the patient may pass from delirium into an unconscious condition, which is marked by muscular tremor, carphologia, and subsultus tendinum. The

urine and fæces are passed involuntarily. The patient has a strange expression, and, although the eyes are wide open and the patient seems to follow the movements of his attendants, he is quite unconscious: a condition to which the term coma vigil has been given.

Convulsions are rare and occur most frequently in children. They may, in adults, follow thrombosis of the arteries or veins of the brain, when they take place late in the disease.

Neuritis occurs in a small number of cases. It is sometimes general, but, as a rule, the lower extremities are affected, causing a paraplegia. Hemiplegia is a rare occurrence.

Poliomyelitis, varying in severity, may follow typhoid fever.

Study of the tendon-reflexes in typhoid fever. In 32 cases out of 100 these are exaggerated; in 22 out of 100 they undergo no change; they are diminished in 17 cases out of 100, and abolished in 29 out of 100. The preservation of the normal reflexes are noted especially in the benign cases and those with pronounced gastric symptoms. During the course of convalescence a marked tendency to exaggeration of the reflexes was observed. The epileptoid trembling of the feet was found in 20 cases out of 100, but it was less frequent than the exaggeration of the patellar reflex. This tremulousness was observed especially after repeated percussion of the patellar tendon. This condition does not seem to manifest itself at the drop of the temperature, but often coincides with profuse sweats and polyuria and appears to deserve notice as a true critical phenomenon. The percussion of the tendon of Achilles sometimes provokes in typhoid fever an epileptoid trembling of the foot. The epileptoid trembling of the knee is not unusual in typhoid fever. P. Remlinger (*Revue de Méd.*, Jan. 10, 1901).

*The Skin.*—A peculiar capillary injection of the skin is frequently noticed. This is of a bright-red or dark-red color

and of an erythematous character. When present, it is usually found during the first week.

The odor of typhoid fever is of such a distinctive character that by means of it a diagnosis can sometimes be made. Cases have been reported in which a peculiarly distinctive odor was noticed, which was the forerunner of death. In one instance the other symptoms were not, at the time, of an alarming character.

The rose-colored spots appear at the end of the first week, usually over the abdomen and lower part of the chest; but they may be scattered over the body, and are found sometimes only on the back. They entirely disappear in the stage of convalescence, but return when there is a relapse.

They appear in successive crops, each crop not lasting longer than three or four days, and they leave a very slight discoloration. They are slightly raised above the skin, rarely vesiculated, and pressure causes them momentarily to disappear. The number of spots at one time may not exceed eight or ten, and only in occasional cases does it exceed fifty or sixty. They are never found on the cadaver. The number is not an indication of the severity of the disease. They are differentiated from acne by their small numbers, short duration, less papular character, and by their not containing pus. The blood drawn from the spots frequently contains bacilli. They are sometimes absent, especially in children.

Sudamina are found in the later stages of the disease when there has been much perspiration. They exist in the form of minute vesicles on the surface of the skin, which soon terminate in fine scales. Sweats are not usually present until the latter part of the disease, but in some

cases they are a marked feature in every stage.

Throughout the disease the skin is, as a rule, hot and dry. The palms of the hands and soles of the feet present thick layers of epidermis of a yellow color.

More or less desquamation takes place, and the hair falls out during convalescence, but grows in afterward. Boils and abscesses often form on the back and buttocks during the stage of convalescence. Bed-sores are present on some cases. Bluish patches of irregular outline are occasionally seen in this as in other diseases. They are the result of deep pigmentation, and occur only upon the skin of those who have body-lice. The *tache cérébrale*—a red line with white borders produced by drawing the nail over the skin—is a vasomotor phenomenon which exists in this as well as in other fevers.

Deafness is very commonly present during the first week, and in severe cases it is more marked toward the end of the second week. It disappears during convalescence unless there has been an inflammation of the middle ear, a condition which rarely occurs.

The conjunctivæ are often congested and the pupils dilated. Keratitis and iritis are sometimes present. The loss of accommodation is frequently found in convalescence, and an oculomotor paralysis, the result of neuritis, has been reported (de Schweinitz). Among rare complications may be mentioned retinal hæmorrhages, double optic neuritis, atrophy of the optic nerve, cataract, thrombosis of the orbital veins, and orbital hæmorrhage.

*Temperature.*—In many cases when the patient first consults a physician the temperature has already reached 102° or 103°, but when a chart has been kept from the very beginning it



shows a gradual rise from day to day peculiar to typhoid fever. There is a daily rise from morning to evening from about  $1\frac{1}{2}^{\circ}$  to  $1^{\circ}$ , and the temperature of the evening is the same as that of the following morning. This gradual rise continues until the end of the first or beginning of the second week. It then remains constant, with daily remissions, until the end of the third and gradually falls during the fourth week. In the third week there may be three or four degrees of difference between the morning and evening temperatures. In the fourth week the fever is rather of an intermittent type, the morning temperature being normal and that of the evening showing a rise of  $2^{\circ}$  or  $3^{\circ}$ . In the abortive form, the fever may disappear at the end of the first week.

In mild cases the temperature, which may at first rise as high as  $102^{\circ}$  or  $103^{\circ}$ , gradually subsides until it becomes normal toward the end of the second week.

When a high fever exists for a number of days in succession, it is an indication of the severity of the disease. Those cases in which the temperature rises rapidly at first to  $104^{\circ}$  or  $105^{\circ}$  are apt to be severe. The writer has, however, observed instances in which the fever was high during the first four or five days, and afterward gradually subsided, and the course of the disease became mild and favorable.

The ordinary temperature-curve may be quite changed by the presence of complicating inflammations, especially of the lungs. Moderate fever is not always an indication of the mild character of the disease. Death from hæmorrhage or inflammation may occur in apparently mild cases.

A sudden fall of temperature toward the end of the second or during the third week is of serious moment, as it usually

indicates either hæmorrhage or perforation.

Cases of apyretic typhoid have from time to time been reported in which the temperature has never risen above the normal standard, and in some there has been a decline as low as to  $95^{\circ}$ .

Cases occasionally occur in which the temperature in the fourth, fifth, or even sixth week pursues a most irregular course. They are often marked by rigors, with rapid elevations, sometimes as high as  $105^{\circ}$  or  $106^{\circ}$ , followed by equally-rapid descents, often to below normal.

Such pyæmic curves may occur when there is no formation of pus to account for them, and not infrequently such patients make a complete recovery. The sudden exacerbations of fever are probably due to the absorption of septic matter through the ulcerated surface of Peyer's patches.

During the stage of convalescence moderate rises of temperature may follow indiscretions in diet, overexertion, or excitement, such as might be caused by the visits of friends.

In occasional cases a moderate elevation of  $100^{\circ}$  or  $101^{\circ}$  may be maintained long after the symptoms of fever have passed away. This is sometimes due to exhaustion, to deficient elimination, and to anæmia.

*The Circulatory System.*—The pulse in typhoid fever is slow in comparison with the temperature. It does not usually rise higher than 100 during the first week and part of the second week. It is then soft, compressible, and dicrotic. In the third week it may become small and rapid. Slight movements in the bed will, in most cases, produce increased frequency of the pulse. A sudden rise during the course of the disease is often an indication of a complicating inflammation or hæmorrhage. During con-

valescence occasionally the pulse continues rapid, and the writer has observed in one case its rapidity to be maintained for months.

Bradycardia (slow pulse), sometimes as slow as 30 per minute, is observed in some cases. This appears to be characteristic of certain epidemics.

In the milder form of the disease the heart may maintain its force throughout, but usually the apex-beat becomes perceptibly weakened, and the volume of the first sound of the heart lessened in the latter stages of the disease. This weakening of the heart is due to degeneration of the myocardium. Occasionally a systolic bruit is noticed, and sometimes in convalescence œdema of the limbs may result from weakening of the cardiac walls from anæmia, or from venous obstruction.

Endocarditis and pericarditis are rare complications of typhoid fever. Venous thrombosis, however, is not unusual, occurring more often in the veins of the lower extremities.

This takes place late in the disease or during convalescence, and is very often attributed by the patient to some unusual exertion.

Among the 215 soldiers suffering from typhoid fever admitted to the Pennsylvania Hospital, there were 30 cases, or almost 14 per cent., of phlegmasia dolens, or milk-leg. In 18 of these 30 cases the left leg was affected alone in three, the right alone in two, and both in 13, the latter generally beginning on the left side when not appearing simultaneously in both. J. M. Da Costa (Boston Med. and Surg. Jour., Mar. 23, '99).

The heart should always be carefully watched during the course of the fever, so that, as soon as dilatation commences, as shown by an accentuated pulmonary second sound in association with alteration of the first sound and displacement outward of the apex-beat, the hypodermic injection of strychnine should be started. For its success it should be em-

ployed early, and not called in only where cardiac dilatation is well marked. Strychnine thus given is far superior to digitalis and strophanthus by the mouth. H. D. Rolleston (Treatment, Oct.; New York Med. Jour., Dec. 27, 1902).

The blood has recently been studied by Thayer, who found that the red corpuscles gradually diminished after the first week, and that the anæmia after convalescence is extreme and requires very careful treatment.

The leucocytes diminish in number throughout the disease, reaching the lowest point toward defervescence. This is an important diagnostic point, as in many inflammations the leucocytes are much increased.

The amount of hæmoglobin is lessened in greater proportion than the red corpuscles, and its return during convalescence is slow.

*The Respiratory System.*—The breathing is little affected in mild cases, but when the disease is severe the respirations become frequent and shallow.

Catarrhal laryngitis is occasionally present, causing greater or less hoarseness. Œdema of the larynx sometimes occurs. A sudden attack of dyspnoea may arise from inflammation and œdema. Bronchitis is so often present that it can scarcely be called a complication. It is usually mild in character. Dry and moist râles are heard in different parts of the chest.

Epistaxis is a frequent and early symptom. The amount of hæmorrhage is usually slight, but in some cases the bleeding is so great that it is necessary to plug the posterior nares to control it. This severe form of hæmorrhage occurs, as a rule, in the later stages of the disease.

*The Urinary System.*—A small amount of albumin is often found in the urine of severe cases. It is of the ordinary



febrile character, and is not an important symptom. In the renal type albumin may appear at the earliest stage in large quantities and continue until the temperature falls.

In 346 cases of typhoid fever in von Leube's clinic, albuminuria was noted in 205, or in 59.2 per cent. In 37 of these 205 cases there were, besides the albuminuria, signs of nephritis present, namely: hyaline and epithelial casts. In every case of nephritis which might be classed as idiopathic, but which has a high temperature, the urine should be examined for typhoid bacilli and the blood tested for Widal's reaction. Rostoski (Munch. med. Woch., Feb. 14, '99).

Sometimes retention is noticed early in the disease, and a catheter requires to be used throughout. Incontinence occurs late in some cases.

As a rule, the amount of urine is lessened during the first week, the specific gravity increased. The reaction, which is at first acid, afterward becomes alkaline. Toward the end of the attack and during convalescence the quantity of urine is increased and the specific gravity is lessened. Uric acid is always increased in the earlier part of the disease, and the chlorides are greatly diminished. During convalescence uric acid is diminished and the chlorides are increased.

The toxicity of the urine is greatly increased, especially when the cold-bath treatment is adopted. Pus is not infrequently found in the urine of typhoid patients. It may arise from cystitis or pyelitis.

The urine during the course of typhoid fever is usually of high specific gravity and in amount below 1500 cubic centimetres in twenty-four hours. In convalescence the amount of urine may rise in a small percentage of cases to 2000, or even to 10,000 cubic centimetres in twenty-four hours. In very rare cases there may be at times polyuria of from 3000 to 8000 cubic centimetres in the twenty-four hours during the entire

course of the disease. M. H. Fussell, H. S. Carmany, and H. Hudson (Medical News, Sept. 17, 1904).

*The Osseous System.*—In childhood and adolescence inflammation of the bone is not an uncommon feature of typhoid. The symptoms may appear during the course of the disease, but more frequently in the stage of convalescence.

Indolence, chronicity, and a remarkable tendency to recur are, perhaps, the most striking features of typhoid bone-lesions. (Osler.)

*Complications and Sequelæ.*—Inflammation of the larynx, with stenosis or destruction of the cartilage, is an occasional complication. The patient becomes hoarse, and may have some difficulty in breathing. Sudden and fatal dyspnoea may take place in very weak patients, when the premonitory hoarseness is referred to weakness rather than to local disease.

The pulmonary inflammations are the most frequent complications of typhoid fever.

In a large proportion of cases more or less hypostatic congestion is present in the posterior portions of the lungs, notwithstanding the care taken by the nurses to prevent it. In many this terminates in consolidation, and a true broncho-pneumonia exists. This is shown by diminished resonance; fine, moist râles; and bronchial breathing heard over the affected part. Broncho-pneumonia may also arise from the presence of foreign bodies (deglutition pneumonia).

Croupous pneumonia may occur early in the disease, when Eberth's bacillus is probably the direct agent. It may also occur in the second and third week, when it is due to the presence of the pneumococcus.

The renal form of typhoid has already been described. Inflammation of the

kidney is not a common sequel. It may, however, occur in the stage of convalescence.

Acute yellow atrophy has been described by Murchison as a sequel of typhoid fever. There are occasionally abscesses of the liver, either single or multiple.

The principal symptoms of this form of suppuration are prolonged and repeated chills, great variations of temperature, profuse sweating, and pains in the hepatic region. Fluctuation, when present, is a valuable sign. The usual causes of abscess are metastasis, pyelophlebitis, and typhoid ulceration in the biliary passages, with secondary suppuration.

Much attention has recently been given to the relationship between typhoid fever and gall-stones.

The fact that gall-stones have been produced experimentally by injecting a culture of typhoid bacilli into the gall-bladder of rabbits, as well as the fact that pure cultures of these organisms have been made from the nuclei of gall-stones found in the human subject, leads to the conclusion that an attack of typhoid fever may, in some cases, be the direct cause of gall-stones and in others predispose to their formation.

Post-typhoid insanity, such as is usually caused by exhaustion, is noticed in a limited number of cases. It disappears within six months or a year.

Cases in which typhoid spine as a complication occurred have been recently reported by Gibney and Osler. Gibney ascribes the condition to an acute inflammation of the periosteum and the fibrous structures which hold the spinal column together. Osler is of the opinion that in many cases the condition is similar to that of hysterical or railway spine, and that it is really a post-typhoid neurosis.

Paraplegia and hemiplegia have already been referred to.

RELAPSE.—In a certain proportion of cases—from 3 to 15 per cent.—usually one and sometimes as many as three or four relapses take place.

They occur after an interval of three or four days of normal or subnormal temperature. They do not seem to be influenced by any form of treatment, and they frequently take place after a change of diet. It has recently been suggested that the digestion of solid food brings about an emptying of the gall-bladder of bile, which latter may be loaded with bacilli, and a second infection then takes place through the intestinal glands. West is of the opinion that any change of diet, even from one liquid to another, —from milk, for instance, to broths,—may cause a relapse.

There is a gradual, but more rapid rise of temperature than in the first attack. The pulse is increased in frequency and the rose-colored spots reappear, together with the characteristic abdominal symptoms. The intestinal glands become again swelled and ulcerated, but the lesions are found higher up the ileum than in the first attack. The spleen remains enlarged throughout the interval and the relapse. Death may occur from the same causes as in the first attack. Relapses do not usually last more than ten or twelve days. They sometimes occur without any interval, and are then called intercurrent relapses. As Wilson states, this may account for some of the prolonged cases of fever.

Elevations of temperature lasting two or three days and caused by excitement or errors of diet must be distinguished from a relapse. In the latter there is a reinfection because the patient has not become sufficiently immune during the first attack.



A second attack of typhoid fever is not common, but cases have been reported in which two or three distinct attacks have occurred.

**INTERCURRENT DISEASES.**—Many instances of the occurrence of another infection with typhoid fever have been recorded. It was at one time thought that malarial fever was a frequent companion of typhoid, and the probability of a hybrid disease—typho-malarial fever—was strongly believed in by many physicians. It is doubtful if there is an instance in pathology of the combination of two diseases to form a third, and, since the discovery of the organism of malaria, the two diseases have rarely been found in the same person. There is therefore no reason for the existence of the term “typho-malarial fever,” and it should be excluded from the list of diseases. The close resemblance between some forms of the æstivo-autumnal type of malarial fever bears to typhoid has partly given rise to this error. Again, cases of typhoid fever sometimes occur with an irregularity of temperature, the result often of a mixed infection which strongly reminds one of intermittent fever.

Certain specific infections have occurred with typhoid fever; for instance, measles, erysipelas, and septicæmia.

Typhoid fever may occur during the course of such chronic diseases as tuberculosis and diabetes, when its course is much less favorable than under ordinary circumstances. In the latter disease the temperature does not exceed  $102^{\circ}$  or  $103^{\circ}$ , but there is a great tendency to adynamia.

**Diagnosis.**—The general diagnostic characteristics are gradual onset, slow rise of temperature with daily elevations, the compressible and dicrotic pulse, epistaxis, the tongue coated with a white

fur dense in the centre and disappearing at the edges, dullness of countenance, meteorism, appearance of rose-colored spots, enlargement of the spleen, and the absence of leucocytosis.

The early diagnosis of typhoid fever has been found difficult on account of the slow development of symptoms and of their resemblance to those of other diseases. The difficulty has been largely removed by Widal's serum-reaction.

[The fact that the blood-serum from immunized animals had the effect of causing the movements of the bacilli to cease and to collect them in clumps had been observed by several pathologists. Gruber, at the Congress for Internal Medicine, 1896, read a paper on the agglutinative power of blood-serum of men who had suffered from cholera and typhoid fever. Widal introduced this method for the diagnosis of typhoid fever.

The profession of this continent was first directed to this means of diagnosis by Dr. Wyatt Johnson, of Montreal, in a paper read at the Buffalo meeting of the American Public Health Association, September, '96 (N. Y. Med. Jour., Oct. 3, '96). Since that time the literature has increased to an enormous volume. J. E. GRAHAM.]

At present the serum for the test is obtained in three ways: from the fresh blood, from the dried blood, and from the fluid of a superficial blister. The first method is the one to be preferred, if possible, for counting leucocytes. The pipette of an ordinary Thoma-Zeiss hæmocytometer may be used and enough drawn up to half-fill the capillary tube, then sufficient sterilized broth is taken up to fill the bulb. In this way a solution of blood-serum 1 to 20 is obtained. The solution is passed into the tube of an hæmatokrit and the corpuscles separated. A drop of the solution is then added to a drop of the culture, making a strength of 1 in 40, and placed under the microscope. When typhoid fever is

present the movements of the bacilli cease, and clumping takes place in from a few minutes to half an hour.

A macroscopical test may be made by adding the blood or serum to a young culture of the typhoid bacillus, when the reaction begins in about two hours. The turbid liquid becomes clarified and a sediment forms of accumulated bacilli. (Osler.)

At the hospital in Milan during the last thirty years typhoid fever has been mistaken for acute tuberculosis 52 times, and tuberculosis for typhoid 90 times. A simpler test than Widal's consists in observing the behavior of 20 to 30 drops of blood drawn from the fingers of the patient into a small test-tube and allowed to remain at rest for twenty-four hours. When the resulting coagulum is observed, it is found that in typhoid hardly any serum is formed, the clot is not retracted. In tuberculosis there is marked retraction of the clot from the sides of the tube, and abundant formation of serum. Carlo Bareggi (*Gazz. degli Osped.*, Mar. 12, '99).

To Wyatt Johnson belongs the honor of introducing the method of examining the dried blood, which has done so much to make this means of diagnosis of so much practical value to physicians both in the city and country.

Result of 297 examinations using dried instead of liquid blood-serum. The preliminary drying of the blood did not seem to interfere with the production of the reaction, and enabled the attending physician to transmit the samples from a distance. The following conclusions were arrived at: 1. The use of dried blood-serum has given us what appear to be satisfactory results for diagnostic work. 2. Complete reaction was rarely delayed beyond the fifth day. 3. A complete reaction was obtained as early as the second day. 4. Typhoid blood allowed to dry sixty days still gave the typical reaction. Johnston and McTaggart (*Brit. Med. Jour.*, Dec. 5, '96).

The agglutinative action of serum tested throughout the different stages in twenty-one cases of typhoid fever. The

curve of the reaction throughout the whole course of the illness is a variable one; it is sometimes slightly marked at first, and increases progressively, or it may remain the same all through. As a rule, it diminishes more or less rapidly during convalescence or even during defervescence with remarkable rapidity, but exceptionally it lasts for months or years. Widal and Siccard (*Science Méd.*, Feb., '97).

The method of serum-diagnosis of typhoid fever is of great practical value. The alteration of the blood on which this method is based is a specific effect of infection or intoxication with the typhoid bacillus. The microscopical serum-test is to be preferred to the macroscopical methods. Quantitative determinations, relating especially to the culture, the time-limits, and the dilution of the serum, are of importance, and, at least in doubtful cases, should not be neglected. As the reaction may be delayed or occasionally absent, a negative result of the test does not exclude the diagnosis of typhoid fever. The persistence of the reaction, sometimes for years, after recovery from typhoid fever, is to be borne in mind in interpreting the reaction in febrile conditions. The appearance of the reaction and its increase during the period of observation speak for fresh typhoid infection. The danger of mistakes from positive reactions in non-typhoid cases can be guarded against in nearly all cases. William H. Welch (*Journal Amer. Med. Assoc.*, Aug. 14, '97).

In more than 90 per cent. of cases of enteric fever a positive reaction may be obtained by means of Widal's reaction; in more than 99 per cent. of these cases examined between the fourth and seventh day, inclusive, a positive reaction may be obtained; in more than 3 per cent. of diseases other than enteric fever a reaction is produced indistinguishable from the typical typhoid reaction; and a negative reaction is obtained with the blood of healthy persons who have not had enteric fever lately. J. C. Da Costa (*N. Y. Med. Jour.*, Aug. 21, '97).

The Widal reaction in typhoid fever does not permit an early unequivocal diagnosis of the disease. The reaction is



an immunity reaction, and not merely a reaction of infection. Due attention being given to the severity of the case, the stronger the reaction, the more favorable is the prognosis. The test has been personally made in 51 individuals who had had typhoid fever. In 20 cases the reaction was positive during the first year after the disease, and in 11 negative. Of those examined more than a year after the fever, 6 were negative and 11 were positive, 1 each after 14, 15  $\frac{1}{2}$ , and 17 months, and 3 after 4  $\frac{1}{2}$ , 2 after 4  $\frac{3}{4}$ , and 1 each after 5, 10, 15, and 21 years. Of the cases in the first year after the disease, 64.5 per cent. were positive. Of 11 cases from the second to the fifth years after the disease, 8, or 72.7 per cent., were positive. If in a case suspected of typhoid fever, the reaction is very strongly positive, it is connected with the present illness, and not with a former attack of the disease. In children under seven years the reaction is feebler than in older persons, and it disappears earlier; nevertheless, it is, in children, perhaps the most valuable sign of typhoid fever. Kasel and Mann (Münch. med. Woch., May 2, '99).

In forty tests for the Widal reactions made on soldiers from the Spanish-American War at the Brooklyn Hospital, this reaction was obtained in all, and the cases went through a typical typhoid. In one suspected typhoid it was not obtained; on examining the blood, Laveran's plasmodium malariae was found. The case responded promptly to quinine. J. M. Van Cott (Brooklyn Med. Jour., Feb., 1900).

During the last year at the Boston City Hospital it has been the custom to perform the Widal test more frequently than at first, and it has been found that, while the reaction sometimes appeared at a very late period,—twenty or twenty-five days from the onset of the fever,—nevertheless it was generally eventually obtained.

The method of applying the test has been the following: A few drops of blood have been drawn from the patient's ear into a small section of glass tubing, sealed at one end by heat and left open at the other. After the serum

has separated, 1 drop of it is mixed with 10 drops of an active culture of typhoid bacillus twenty-four to thirty-six hours old. The dilution is, therefore, 1 to 11, or 9 per cent. For a control, a few drops of an unmixed culture are usually put on the other end of the slide. If immobility and clumping are present in the serum-culture mixture in course of one-half hour, the reaction is reported as positive, otherwise not. In the majority of cases the reaction appears in ten to fifteen minutes.

At the City Hospital during a period of six months, from May 28 to November 28, 1900, there were 253 cases of typhoid fever in the hospital, which were tested, repeatedly, by the Widal reaction, in all cases until a positive result was obtained. In 10 of these cases there was a constant absence of Widal reaction, or 4 per cent. of failures.

A typical instance of the tardiness of the Widal response is illustrated in 1 case, where, after eight consecutive failures, it was positive for the first time on the twenty-ninth day. C. F. Withington (Boston Med. and Surg. Jour., May 9, 1901).

The examination of the urine in cases of suspected typhoid is of value provided its limitations are recognized; the reaction is more constantly present in typhoid than the Widal reaction; in the majority of instances the diazo-reaction is present 48 hours earlier than the Widal reaction; it disappears early, and, therefore, results obtained later than the second week are of little value; doubtful reactions have slight significance. J. S. Billings, Jr. (New York Med. Jour., April 18, 1903).

Previous to the introduction of Widal's test the diagnosis of typhoid fever was sometimes confirmed by the finding of the typhoid bacillus in the blood from the spleen or from the rose-colored spots. These methods have been superseded and are not now employed. The same might be said of Elsner's and Capaldi's methods of cultivating the bacilli from the stools of typhoid patients.

There is no single symptom on which alone an early diagnosis of typhoid fever can be made. It is only by careful consideration of the symptom-complex that a clinical diagnosis can be arrived at. The most trustworthy, as well as the earliest, sign of typhoid fever is the presence in the circulating blood of the bacillus of Eberth. The demonstration of the bacillus of Eberth in the blood is not beyond any fairly well equipped laboratory. The bacillus of Eberth is found in the fæces later than in the blood, but with comparative ease. The presence of the bacillus typhosus in the fæces is of great value as a corroborative sign. W. C. Rucker (Journal of the Association of Military Surgeons, Sept., 1904).

The diazo-reaction of Erhlich is still considered a valuable test. Two solutions are used: one a saturated solution of sulphanilic acid in a solution of hydrochloric acid (50 cubic centimetres to 1000 cubic centimetres), the other a  $\frac{1}{2}$ -per-cent. solution of sodium nitrite. The test is made as follows: To a small quantity of urine in a test-tube an equal quantity of the sulphanilic-acid solution and a solution of sodium nitrate is added. A solution of ammonia is now allowed to flow down the side of the test-tube. It forms a clear layer above the urine and at the junction a layer of reddish color will be noticed. When the tube is shaken the foam presents a well-marked pinkish tinge. The test is readily applied, but has the disadvantage of being present in malaria, tuberculosis, and in some febrile conditions.

The diazo-reaction appears in many diseases, but is constant in measles and typhoid fever. In the latter it bears a distinct relation to the severity of the case. It arises as a result of absorbed intestinal toxins of the disease, which become changed in the blood and furnish the reaction in the urine. Its disappearance indicates early improvement when other signs of this change are wanting,

while its reappearance is a sign of relapse. Certain drugs produce it, but these may be distinguished from the genuine reaction by its slowness, and by the absence of the green precipitate. Its presence with Widal's reaction is a positive sign that typhoid fever is present. Iszö Hönig (Klinisch-therap. Woch., Aug. 5, 1900).

The diazo reaction is of importance in differentiating a relapse from a complication in typhoid fever. It may be of signal assistance in separating measles from German measles. It has great prognostic significance in pulmonary tuberculosis. It does not appear until late and is usually noted in a rapid case. When it once appears it persists until death. The average duration of life after the appearance of the diazo is about six months. An unfavorable prognosis should be given in every patient presenting this reaction.

The diazo reaction at a dilution of 1:40 is of some value in the diagnosis of typhoid fever, but upon employing a dilution of 1:150 other conditions are eliminated (except a small percentage of tuberculous cases), and the test, therefore, is considerably enhanced in value. W. T. Cummins (University of Pennsylvania Medical Bulletin, Sept., 1904).

Modern methods of examining the blood may be of value in diagnosis. Thayer is of the opinion that ("Post-typhoid Anæmia," page 109) the examination of the leucocytes may be of great value. The examination of a fresh specimen of the blood may exclude malaria by the absence of the *Plasmodium malariae*. In tuberculosis with local inflammation and in acute tuberculosis there is an increased leucocytosis.

In the absence of leucocytosis and the change in the relative proportion of the different varieties of colorless corpuscles one to another we have two valuable points, which, while neither may be pathognomonic, are of considerable diagnostic value.



The differentiation between typhoid fever and malaria has already been referred to. The therapeutic test, the administration of quinine, will sometimes distinguish between the two diseases.

Lobar pneumonia of the pneumococcal origin may be difficult to distinguish from that produced by the typhoid bacillus. The methods already mentioned, Widal's reaction and the blood-examination, will be sufficient if one is only on his guard to make the tests. Pyæmia from some concealed source is often mistaken for typhoid fever, and the tests just mentioned are of great value. Septic endocarditis may closely resemble typhoid.

The approach of the organism, on the one hand, to the typhoid bacillus and, on the other, to the colon family is well shown by the cultured properties. The effect on milk and the non-production of indol are like the typhoid bacillus, and in the fermentation of glucose it resembles the colon family.

*Bacillus coli communis* possesses to a marked degree the power of reducing neutral red, producing a canary yellow fluorescent color of the medium. The so-called bacillus enteritidis of Gaertner also produces this reaction, and is probably only a variety of *bacillus coli communis*.

The bacillus typhosus never possesses this power of reduction, nor do the common pathogenic micro-organisms give it. By means of neutral red it is possible within from twelve to twenty-four hours to diagnose with absolute accuracy the presence of *bacillus coli communis*. As far as personal experience goes, it is possible to diagnose by means of neutral red the true coli group from the typhoid group of micro-organisms. William Hunter (*Lancet*, Mar. 2, 1901).

**Etiology.**—Typhoid fever is caused by the introduction of the bacillus typhosus

into a system not immune to the disease; by its subsequent growth, which occurs usually in glandular structures; and by the development of a special form of poison.

The disease is more prevalent during certain seasons of the year and under certain circumstances, owing either to an increased number and virulence of the micro-organisms or to a lessened power of resistance in the individual.

Age seems to exert an important predisposing influence. It is rarely found under two years and not often after fifty. A case has been recorded of an infant at six months, and the disease has even been found in the foetus.

Analysis of 284 cases of typhoid fever in childhood:—

	Per-centage.
Up to five years.....	3 1
Five to ten years.....	77 27
Ten to fifteen years.....	204 72
	—
	284

Vogel, in 1017 cases, found 412 between five and ten years of age and 393 between ten and fifteen. Collectively they show a comparatively small number in the first five years, while the remainder are about equally divided between the two other periods. John Lovett Morse (*Boston Med. and Surg. Jour.*, Feb. 27, '96).

Investigations made by means of Widal's serum-reaction on 50 cases of suspicious gastro-enteric disturbances in children: 1. Typhoid fever, as has been commonly believed, is an unusual disease in infancy. 2. It is possible that women whose blood gives a positive Widal reaction, even though it be years after the occurrence of the disease, may in some way transmit this to their infants. J. L. Morse and H. W. Thayer (*Boston Med. and Surg. Jour.*, Jan. 12, '99).

It is safe to conclude that this reaction occurs under the same conditions and with the same limitations in children as in adults. There is evidence to show that in them reaction appears

earlier, is feebler, and persists a shorter time than in adults. The serum-test, therefore, is of especial value in two ways in the diagnosis of typhoid fever in children: first in ruling out many cases of gastro-intestinal disorders which might otherwise be mistaken for typhoid; and, second, in making a positive diagnosis possible in many mild cases which might otherwise pass unrecognized. J. L. Morse (*Archives of Pediatrics*, May, 1901).

Cases have also been reported of the disease in patients over seventy years of age. The writer attended during the past year a patient of sixty-eight. Infants are probably exempt on account of lessened exposure, and old people are rendered immune from previous attacks, but these are not altogether sufficient reasons. Infants are frequently brought up on cows' milk which may contain bacilli, and a large number of individuals pass through middle life without having had typhoid fever. The great majority of cases occur between the ages of fifteen and thirty. Of 1375 cases treated in the Toronto General Hospital from 1890-'97, inclusive, 1016 occurred between the ages of ten and thirty. The mean age in 1772 cases, according to Murchison, was twenty-one years.

Males and females seem equally liable to the disease, although in hospital statistics males predominate. Of 1375 Toronto Hospital cases, 874 were males and 504 females. According to some statistics, boys are more frequently affected than girls. This may arise, as Wilson has pointed out, from the fact that boys, in their out-door sports, are more exposed by drinking impure water.

The great majority of cases occur during the last four months of the year, and from February to May there is a comparative freedom from the disease. Special epidemics may take place at any season and some of the most severe have

prevailed during the spring months. Eight hundred and twenty-eight of the 1375 Toronto cases came into the hospital during the last four months of the year.

It is especially prevalent after hot, dry seasons and less so when the summer has been wet and cold. Recent experiments by Robertson demonstrate the fact the typhoid-fever germs grow luxuriantly in the soil during the summer and remain dormant in the winter.

Locality seems to make little difference. It occurs with equal prevalence in cities, towns, villages, and country houses. Soldiers in camps seem especially liable to the disease, on account of the ease whereby the virus may be conveyed from one to another.

Antityphoid inoculations used in India on British troops, using lysolized, four-weeks-old cultures of a virulent typhoid bacillus, prepared twelve months previously. The quantity employed for each inoculation varied between 0.5 and 0.7 cubic centimetre. Some vaccine-material was also prepared in Calcutta and Agra with virulent typhoid cultures grown for twenty-four hours in nutrient agar at a temperature of 37° C., and sterilized at 60° C. The quantity of this employed at each inoculation varied between 0.3 and 0.5 cubic centimetre. Both varieties gave fairly severe reactions in man, and showed a distinct degree of protection when the case-mortality of the inoculated was compared with that of the uninoculated. A. E. Wright (*Lancet*, Jan. 20, 1900).

Results of the use of vaccine in fourteen nurses. These were inoculated in the evening and allowed to rest the next day. Since 1895 the nurses on the staff have shown from 3 to 8 cases of typhoid fever yearly, while from September, 1899, to March, 1900, the time during which the inoculations have been carried out, not one case had been seen, unless one doubtful case was typhoid. Marsden (*Brit. Med. Jour.*, Apr. 28, 1900).

Question recently asked in the British



Parliament as to the measure of protection conferred upon soldiers by the inoculations introduced by Professor Wright. Out of 11,000 men, 2835 were treated, and most of these were young and unseasoned. Of these only 27, or 0.95 per cent., contracted enteric fever, and 5 died therefrom. Of the uninoculated, 213, or 2.5 per cent., contracted it and 23 died. These statistics were called for from every station at home and abroad. (Treatment, June, 1900.)

Typhoid among the American soldiers in 1898; more than 90 per cent. of the volunteer regiments developed typhoid fever within eight weeks after assembling in encampments, and all of the regular regiments in less than eight weeks. It became epidemic both in the small encampments of one regiment camp, and in the larger ones, containing one army corps, in the North as well as in the South.

The investigations confirm the doctrine of the specific origin of typhoid fever. Infection was due to the great difficulty of disposing of the excretions in camps. Pollution of the latter was the main source, though some camps were unwisely located. The space allotted to some regiments was also inadequate, and many commands were allowed to remain on one site too long. Requests for change, made by medical men, were not always granted. Greater authority should be given medical officers in such matters.

The tub system, as well as that of the regulation pits, is condemned. In permanent camps where water carriage cannot be secured, all faecal matter should be disinfected and then carried away from the camp. Flies serve as carriers of infection, but infected water was not an important factor in the spread of the disease. Personal contact was a probable means of infection; dust-laden air may have contributed somewhat to its spread. An infected command does not lose the infection by change of location. Besides this change of camping-ground, there must be a thorough disinfection of all equipment. The percentage of deaths among the cases of typhoid fever was

about 7.5. V. C. Vaughan (Jour. Amer. Med. Assoc., June 9, 1900).

At Ladysmith the proportion of attacks and deaths from typhoid fever was seven times smaller in the inoculated than in the uninoculated. If the number of men who had previously suffered from typhoid fever had been subtracted from the number of the uninoculated, the statistics would have shown even better results. As it is, the proportion attacked by typhoid fever was but one-seventh as great in the inoculated as in the uninoculated. A. E. Wright (Lancet, July 14, 1900).

In 100 cases of enteric fever treated at No. 6 Military General Hospital, Naauwpoort, South Africa, the death-rate among the inoculated was 23 per cent. lower than that among the non-inoculated; the average temperature among the inoculated was 0.9 degree lower for the first ten days; but in the inoculated the temperature was fifty-four days longer, on the average, in returning to the normal. Parker (Lancet, Aug. 25, 1900).

According to Pettenkofer, the condition of the soil has much to do with the causation of the disease. It is more prevalent when the ground-water is low after a dry season, and an outbreak of the disease frequently follows a heavy rain-storm after a period of drought. The disease may be more readily conveyed in dust during the dry season (Baumgarten).

Typhoid fever sometimes occurs far away from human habitation. One form of what is called *mountain-fever* is essentially typhoid in character. The cause of the disease may exist in canned meats and milk, which are the principal food of miners and prospectors. This explanation does not seem sufficient, because, in some district of the Rocky Mountains, almost every newcomer is liable to take the disease. The possibility of the wide distribution of the typhoid germ in the soil and in inferior animals has been given as an explanation for such cases.

Typhoid fever is a very widely distributed disease. It is endemic in Europe and North America. In America it prevails equally from Hudson Bay to the Gulf of Mexico and from the Atlantic to the Pacific.

Individual immunity may be either hereditary or acquired from a previous attack. It is quite probable that the individual when weakened by overwork from unhealthy surroundings or from a previous disease is more liable to an attack of typhoid. In a large proportion of cases, however, the previous health of patients has been good.

*The Bacillus Typhosus.*—Pathologists have been for many years of the opinion that typhoid fever was caused by a distinct virus. Flint, in the second edition of his work, published in 1867, wrote as follows: "Assuming these statements to be correct, typhoid fever is one of the diseases the special cause of which may be generated without the body and reproduced within the body."

The bacillus discovered by Eberth, a short, thick, straight or very slightly curved, rod-like body with rounded extremities is now looked upon as the cause of the disease. It is found especially in the intestinal and mesenteric glands and in the spleen and occasionally in many other parts of the body, as well as in the blood.

After the first ten days these organisms are found in large numbers in the passages from the bowels. They can be readily differentiated from the *b. coli communis*, with which they were at first confounded. These organisms are found in all cases of typhoid fever, and they can be cultivated outside the body. For some years all attempts to inoculate animals failed. Abbott reported a case in which the disease had been communicated to rabbits by inoculation. The

typhoid bacilli were found in enlarged mesenteric glands and in the spleen. More decided cases of the communication of the disease to inferior animals have recently been reported.

If these conclusions are confirmed by further experiments, the three requirements of Koch's law will be amply satisfied and the bacillus of Eberth will be as conclusively proved to be the cause of typhoid fever as Koch's bacillus of tuberculosis.

So far as is known in the great majority of cases, the port of entry for the bacillus is the alimentary canal.

The most frequent source is the drinking-water, but it may be taken in milk and other articles of diet. Bacilli may be inhaled in the form of dust into the mouth and pharynx and afterward swallowed. It is possible that the organism may be inhaled into the lungs and may invade the system in that way. Cases of pneumonic typhoid have recently been reported which demonstrated the possibility of this mode of invasion.

Many local epidemics have resulted from the pollution of drinking-water, and one especially which occurred in Plymouth, Penna., in 1865, demonstrated positively this mode of the introduction of bacilli into the system. Plymouth was supplied from a reservoir into which ran several small streams. During January and February a case of typhoid fever occurred in a house on the bank of one of the streams. The dejecta were thrown out upon the snow and became frozen. About the end of March, a thaw and rain-fall took place, which carried the impurities into the reservoir. Toward the middle of April typhoid fever appeared in different parts of the city supplied with water from the reservoir. Twelve hundred cases occurred in a town with a population of eight thousand.



The Maidston epidemic was caused in a similar way.

The water from contaminated wells is a frequent source of disease, and this is more especially the case in smaller towns where there are neither water-works nor sewerage. Water from such wells is deceptive, as it is frequently clear and sparkling and is preferred to that of a much purer quality.

Milk is frequently a medium of transmission. The bacilli are introduced by washing of the pans with impure water. They will afterward multiply in the milk itself, which is a good culture-medium. Direct contamination may take place when those who milk the cows are in attendance upon typhoid patients. Milk allowed to remain open to the air may be contaminated by dust or by flies conveying the bacilli.

Oysters are a not-infrequent source of contagion, and epidemics have been brought about by their consumption. The oysters are fattened in ponds communicating with the estuaries of rivers, the water of which is polluted with sewage.

Klein made an investigation with regard to the presence of bacilli in oysters, and found them in only one instance in those supplied to the trader. He demonstrated the fact that when oysters are placed in water containing bacilli these organisms will be found within the shells as late as the seventeenth day after their removal from the water, establishing clearly the possibility of the conveyance of typhoid fever by this means. It is probable that other articles of food may become contaminated by germs which arise from dried filth. Typhoid bacilli may also be taken in on the surface of raw vegetables which have been washed in water containing typhoid organisms.

The principal source of the bacillus is

in the passages from the bowels of typhoid patients. They are also given off in the urine, vomited matter, and sputum, and they may possibly be exhaled from the lungs. Not a great deal is known of the life of the micro-organism outside of the body. They multiply in water and in the soil.

*Direct Contagion.*—Cases of what appeared to be direct contagion have from time to time been reported. The attendants upon patients become ill in so short a time that it did not seem possible that the fever was commenced in the ordinary indirect way. In such instances the typhoid germ may be inhaled into the mouth and pharynx and afterward swallowed. Practitioners in the country have sometimes observed that, when a case of fever is imported into a previously healthy home, the attendants will, inside of two weeks, be attacked by the disease.

*Pathological Anatomy.*—The lesions of typhoid fever are found principally in Peyer's patches and solitary glands of the small and large intestines in the mesenteric glands and in the spleen. Changes are also found in the gall-bladder and the muscular structure throughout the body, especially that of the heart. Ulceration of the stomach is very rarely present.

Peyer's patches are made up of a collection of glands, and exist principally in the lower part of the small intestines. The change first noticed in them is an elevation above the surface, due to infiltration of the glandular structures with leucocytes. The elevation is usually of an elliptical form lengthwise with the lumen of the bowel. The induration is of a whitish or opaque appearance, and may extend beyond the glandular structure even through the muscular and serous coats of the intestines.

This swelled condition reaches its

height about the end of the first or the beginning of the second week, when resolution may take place. In some death follows from the severity of the fever before the commencement of necrosis of the glands.

The circulation in the patch becomes impeded by inflammatory exudations and by innumerable colonies of bacilli, which produce virulent toxins. The slough which begins to form on the surface may involve a part or a whole of the gland. It usually extends to the submucous coat, but may exist more deeply. Often the necrosis takes place in several different parts of a patch, and three or four distinct ulcerations may be found in one gland.

Ulceration begins at the edge of a slough, gradually separating it from the healthy tissue and leaving an ulcer with excavated edges, oval in form, presenting a smooth base of submucous, muscular, or peritoneal tissue. When death occurs, some glands may be found in the first stage, and often the three conditions—swelling, necrosis, and ulceration—will be found in the same patient. The process becomes more severe toward the cæcal valve. During and after the separation of the slough healing takes place, leaving a slight depression and causing little or no contraction of the lumen of the bowel. The mucous membrane gradually extends over the site of the previously-existing ulcer. This takes place in the third and fourth weeks. In some cases the ulceration extends through the peritoneal coat, allowing the contents of the intestines to pass out into the peritoneal cavity.

During the process of sloughing and ulceration slight extravasation of blood may take place from distended capillaries, and sometimes an artery is opened, causing severe and fatal hæmorrhage.

Secondary ulcerations occasionally occur in the cicatrices, which are said to cause hæmorrhage more frequently than in the primary form.

The solitary glands of the small intestines are not always affected, but when involved present roundish elevations and ulcerations. The solitary glands of the large intestines undergo the same changes. The necrosis and ulceration follow in the same way as in Peyer's patches.

Typhoid without intestinal lesions studied in 23 cases collected, including 2 personal cases. In 14 of the cases the evidence was decisive in favor of the existence of a typhoid infection without intestinal lesion. It is probable that infection takes place through the intestine, even though there are no manifest lesions to be found. In the two personal cases there was bacteriological evidence of typhoid, but the intestines were normal. Picchi (*Lo Sperimentale*, anno 53, fasc. 4, 1900).

The mesenteric glands are enlarged from the presence of leucocytes and contain numerous colonies of bacilli. Occasional softening, breaking down, and rupture take place, causing fatal peritonitis. Hæmorrhage may also arise from this source.

The spleen is enlarged, but never to a great extent. Osler never found it weighing more than 20 ounces. The substance is soft, and infarcts are not infrequently found. Ruptures may take place from accidents or spontaneously.

This organ may be slightly enlarged and soft in consistency. The lesions most frequently found are lymphoid nodules and small, grayish, opaque areas. The latter vary in size, sometimes involving only a few hepatic cells and sometimes half a nodule. They are foci of necrosis which do not bear any relation to the colonies of bacilli and are probably produced by the toxins of the dis-



ease. As a rule, these do not give rise to any symptoms, but when extensive may afterward terminate in cirrhosis (Osler). Swan (Brit. Med. Jour., July 16, '98) reports a case of hepatic abscess caused by the bacillus typhosus. The abscess resulted from infective pylephlebitis by direct extension from the intestinal ulcer. Bacteriological examination of the abscess-contents revealed the presence of typhoid bacilli, which gave the usual Widal reaction with typhoid serum. The patient, a female child, 5 years of age, was operated upon and the abscess, which existed about half an inch below the surface of the liver, was evacuated. Recovery followed.

Osler (Edinburgh Med. Jour., Nov., '87) speaks of suppurative pylephlebitis as one of the rarest sequelæ of typhoid fever. Of solitary abscesses the Munich statistics give 12 out of 2000 cases. Suppurative cholangitis may terminate in abscess of the liver, and abscesses may follow the formation of pus in other parts of the body. Louis has recorded a case which followed suppuration of the parotid. In a case of Chvostek's two large hepatic abscesses followed bone-lesions.

Blackstein in 1891 found typhoid bacilli in the biliary passages of rabbits some weeks after they were introduced into the gall-bladder.

Chiari found typhoid bacilli in 19 out of 21 cases. They existed in large numbers in most of the cases. He thinks that a reinfection might be caused by the emptying of the gall-bladder after a full meal and the filling of the intestine with an infected fluid. Murchison states: "The lining of the gall-bladder is very liable to become inflamed in enteric fever without producing any marked symptoms during life."

In ordinary cases the kidneys are lit-

tle, if any, affected. In the severe forms cloudy swelling of the epithelial lining, with degeneration, may be present. Small areas of round-celled infiltration, in which softening and suppuration may take place, are referred to by Osler. Nephritis occasionally sets in during the post-typhoid period. Catarrh of the bladder is sometimes met with, and may be brought on by the careless use of the catheter for retention. Diphtheritic inflammation of the pelvis of the kidney and bladder has been noted.

The heart-muscle is more or less degenerated. In severe cases the heart is flaccid and easily torn, and the muscle presents a reddish-brown color. Endocarditis and pericarditis are rare complications. Endarteritis with thrombosis is sometimes met with. Thrombi and emboli may contain bacilli. Phlebitis with thrombosis, especially in the lower extremities, is a frequent lesion.

Inflammation of the lining membrane of the larynx is sometimes met with, as well as of the deeper lesions involving the cartilage. These terminate sometimes in stenosis, ulceration of the cartilage, with formation of pus, which may penetrate into the mediastinum. Emphysema sometimes results. The danger of ulceration of the cartilage is shown by the mortality: 71 out of 75 cases (Keen).

Lobar and broncho-pneumonia have been already referred to. Pleurisy and empyema are very occasionally found after fever.

Zenker has described two forms of muscular degeneration: the granular and the waxy. The former is similar to the advanced stages of fatty degeneration, and in the latter the contractile substance is changed into a waxy, homogeneous mass. This form of degeneration occurs in other fevers as well as in typhoid. Inflammation of the me-

ninges is not a frequent complication. Typhoid bacilli have been found in the suppurative form. I had under observation some years ago a case of typhoid fever with symptoms of meningitis and with well-marked neuritis. The patient recovered.

Hoffmann has described an atrophy of the brain in the later stages with smaller size of the convolutions and greater width of the lateral ventricle. Degeneration of the ganglion-cells as well as of the nerve-fibres has been described. This is present in many cases when there are no symptoms of neuritis.

Galezowski has classified the pathological condition of the eye in typhoid fever into: Necrosis of the cornea; thrombosis of the ophthalmic and orbital veins; emboli of the central artery of the retina; optic neuritis with atrophy of the disk (de Schweinitz).

**General Pathology.**—The question has been much discussed as to whether the intestinal lesions of typhoid fever are the result of a local infection or are a local manifestation of a general disease.

The theory of general infection is supported, to some extent, by Sanarelli's experiments. He found that whether the bacilli were introduced under the skin or into the peritoneal cavity, the principal lesions were found in the abdominal organs, and an acute mucous inflammation of the intestine existed, as well as swelling of Peyer's patches. Martin points out the fact that these lesions are the result of the toxins, and not of the bacilli, and are produced also by other toxins, as those of the colon bacillus, Gärtner's bacillus, as well as by the vegetable toxins: abris and ricin. Ulceration has rarely followed such intravenous or subcutaneous injections.

The fact, previously mentioned, that Remlinger has produced in animals the

intestinal lesions by feeding them with a pure culture of typhoid bacilli and that the result has not previously been reached by subcutaneous injections would confirm Martin's view.

**Prognosis.**—Death in typhoid fever may result from asthenia, or from intercurrent diseases and accidents, the results of typhoid lesions. The severity depends upon the virulence of the poison, as well as upon its amount and on the nature of the soil. This has been demonstrated by experiments on animals.

The rate of mortality in typhoid-fever cases is from 7 to 15 per cent. Cayley gives that of the Continental hospitals at from 7 to 15 per cent. Delafield collected 1305 cases of typhoid fever in five years in the New York Hospitals, with a mortality in 1879 of 21 per cent. and in 1880 of 30 per cent. (Wilson.)

Murchison's statistics of 18,612 cases collected from British and Continental hospitals gives 18.62 per cent. of deaths. They also prove that the mortality is lower between ten and fifteen years of age.

The previous condition of the patient bears some relation to the prognosis. A system weakened from overwork or unhealthy surroundings, or one with a family history of tuberculosis, will not withstand the disease as well as one who has been previously strong and healthy.

When the temperature rises suddenly at first and remains high for a number of days, the prognosis is usually grave. The writer has had under observation cases of rapidly-rising temperature when the temperature, after four or five days, partially subsided, the disease afterward running a comparatively mild course.

Deaths in the first week from an overwhelming disease are rare. Death from asthenia is usually delayed until the third or fourth week. A continued high tem-



perature, delirium, and ataxia, with tremors and diarrhœa, may have been present throughout.

Prognostic sign suggested by Trousseau many years ago: When deafness is present only on one side the prognosis ought to be guarded, for the patient almost always dies, although the disease at that time may appear very mild. If the deafness occur on both sides, however, the prognosis is good, for it is said that persons are almost never seen to die when this symptom is present. No explanation for this unusual phenomenon is offered, but its value may be learned by experience. W. C. Doane (New York Med. Jour., April 26, 1902).

A fatal result should not be confidently predicted, even in the most severe cases. It is surprising how weak a patient may become and how long the weakness may continue and recovery still take place. Sudden death from cardiac complications, as heart-failure or delirium cordis, occurs more frequently in men than in women. Persistent vomiting is a grave prognostic symptom.

In cases of pregnancy abortion occurs in a large proportion, and death often follows. The mortality is about 20 per cent. When typhoid occurs in childbed the prognosis is unusually grave. In seven cases reported by Liebermeister, three died.

The previous habits of the patient, especially the alcohol habit, has a strong influence in increasing the mortality. Of nineteen notorious drunkards admitted into the Basel hospital seven died, more than one-third (Liebermeister).

The prognosis is rendered more grave by the presence of intercurrent diseases: bronchitis, lobar pneumonia, the invasion of the streptococcus and staphylococcus. It has recently been shown by Martin that the typhoid bacilli are more virulent when other organisms are present in the system. When patients suffering from

tuberculosis, emphysema, and diabetes are attacked by typhoid fever, the outlook is grave. This is also the case with elderly people.

Death from hæmorrhage occurs in 3.77 per cent. of all cases, according to Murchison's statistics. A moderate amount of hæmorrhage may take place without danger. When frequent small extravasations occur daily, patients may still recover, although they indicate active ulceration and consequent danger of perforation. They are premonitory symptoms of severe hæmorrhage, although the latter may occur in cases which have been running a mild course. The possibility of sudden death from cardiac weakness should always be borne in mind.

The younger the patient the more favorable the prognosis, as mild cases are commonest to the young, while fatal complications are apt to occur in the old. If the onset of the disease be gradual, it is likely to prove a mild case; but if the onset be sudden, then a severe case must be looked for. If the case be one occurring in an outbreak of typhoid fever, then the general character of the outbreak may be of value in prognosis, the age and constitution of the patient being taken into account. The amount of pyrexia *per se* is not to be regarded as unfavorable in a patient of strong bodily health. The pulse rate is a good indication of the severity of the attack. Sudden changes in its rate are important guides to the onset of complications.

Constipation is a favorable symptom contrasted with diarrhœa, which is unfavorable. Meteorism is an unfavorable symptom, because it favors perforation. Where perforation occurs, operative measures hold out the best chance. The dryness of the tongue is a valuable guide to prognosis. Hæmorrhage occurs chiefly in serious cases. The earlier it occurs in the disease, the more serious it is. Early nerve symptoms must be

regarded seriously, for they are indication either of the severity of the attack or the lack of resistance in the patient. Most of the complications tend to recovery, serious complications being perforation, peritonitis, and pneumonia. When perforation occurs, laparotomy is the only treatment. Hospital-treated patients have a better chance of recovery than home-treated patients. R. E. Sedgwick (Birmingham Medical Review, February, 1904).

**Treatment.—PROPHYLAXIS.**—The important measures for the prevention of typhoid fever are:—

1. The isolation of the patient and thorough disinfection of the excreta.

2. The careful inspection of the drinking-water, as well as the source of supply and the means by which it is conveyed.

3. Careful inspection of the food, especially of the milk.

4. Cleanliness of the surface, the removal of garbage and other impurities, and the prevention of the saturation of the soil by sewage.

1. The complete isolation of the patient is necessary for many reasons. The attendant upon a typhoid case may convey the bacilli directly by handling food or drink, which is given to healthy members of the household. If care is not taken, the excreta may become dried and the germs may be scattered about in the dust or a few of them may light on milk or meat and there multiply indefinitely. Dried bacilli may be inhaled and swallowed, or possibly they may be inhaled into the lungs and there multiply.

The sick-room should be well ventilated and absolutely clean. The patient should be sponged regularly and all soiled clothing at once removed. The nurse should cleanse her hands with a mild disinfectant solution whenever they are soiled.

The disinfection of the discharges should be very thoroughly made, and in

small towns and country places they should not be thrown into the ordinary privy or cess-pool, but should be buried. The urine should be treated in the same way, as it frequently contains bacilli.

Disinfection of typhoid urine:—

1. For disinfection immediately and within five minutes, a volume of infected urine would require the following proportion of disinfectants:—

$\frac{1}{2}$  its volume of 1 to 20 carbolic-acid solution.

$\frac{2}{3}$  its volume of 1 to 40 carbolic-acid solution.

$\frac{1}{5}$  its volume of 1 to 1000  $\text{HgCl}_2$  solution.

$\frac{3}{10}$  its volume of 10-per-cent. formalin.

$\frac{1}{40}$  its volume of chlorinated-lime solution.

$\frac{2}{5}$  its volume of liquid chlorides.

2. For disinfection within five to fifteen minutes, a volume of urine would require:—

$\frac{2}{5}$  its volume of 1 to 20 carbolic-acid solution.

$\frac{1}{2}$  its volume of 1 to 40 carbolic-acid solution.

$\frac{1}{20}$  to  $\frac{1}{10}$  its volume of 1 to 1000  $\text{HgCl}_2$  solution.

$\frac{3}{5}$  its volume of 1-per-cent. formalin.

$\frac{2}{5}$  its volume of 5-per-cent. formalin.

$\frac{1}{5}$  its volume of 10-per-cent. formalin.

$\frac{1}{40}$  its volume of chlorinated-lime solution.

$\frac{3}{10}$  its volume of liquid chlorides.

3. For disinfection within one-half to one hour, a volume of urine would require:—

$\frac{3}{10}$  to  $\frac{4}{10}$  its volume of 1 to 20 carbolic-acid solution.

$\frac{2}{5}$  its volume of 1 to 40 carbolic-acid solution.

An equal volume of 1 to 100 carbolic-acid solution.

$\frac{1}{40}$  its volume of 1 to 1000  $\text{HgCl}_2$  solution.

$\frac{1}{20}$  its volume of 1 to 2000  $\text{HgCl}_2$  solution.

$\frac{1}{10}$  its volume of 10-per-cent. formalin.

$\frac{3}{10}$  its volume of 5-per-cent. formalin.

$\frac{1}{2}$  its volume of 1-per-cent. formalin.

$\frac{1}{10}$  its volume of liquid chlorides.



4. For disinfection within one to two hours, a volume of urine would require:—

$\frac{2}{10}$  to  $\frac{3}{10}$  its volume of 1 to 20 carbolic-acid solution.

$\frac{2}{5}$  to  $\frac{3}{5}$  its volume of 1 to 40 carbolic-acid solution.

More than its volume of 1 to 100 carbolic-acid solution.

$\frac{1}{80}$  to  $\frac{1}{50}$  its volume of 1 to 1000  $\text{HgCl}_2$  solution.

— $\frac{1}{10}$  its volume of 10-per-cent. formalin.

— $\frac{3}{10}$  its volume of 5-per-cent. formalin.

— $\frac{1}{2}$  its volume of 1-per-cent. formalin.

An equal volume =  $\frac{1}{2}$  its volume of milk-of-lime solution.

For the disinfection of the urine in the bladder and urinary system urotropin is the only substance which can claim any direct action when administered by the mouth. As irrigations, bichloride solutions 1 to 100,000 to 1 to 50,000 have been very successful, removing the bacilli with much more certainty than any other method. Gwyn (Phila. Med. Jour., Jan. 12, 1901).

The urine of typhoid-fever patients should always be disinfected. From a hygienic stand-point bacteriological examination of the urine of patients convalescing from typhoid fever is important and should never be omitted before patients are allowed to go at large, so that proper precautions may be taken to guard against the dissemination of typhoid bacilli by the urine. This is an often neglected source of infection that should be seriously considered in the hygiene of typhoid fever.

Fæces, of course, should be disinfected at all stages of the disease, but, the organisms being present generally only from the beginning of the second week to the fall of the fever and the patient during this period usually being confined to bed, the fæces are not such a source of infection to the community at large as the urine.

The bacilli may, on account of the lung and throat lesions, be present in the mouth of those suffering from typhoid fever; hence the expectoration should be disinfected, as well as all

eating utensils, etc., used by the patients. P. H. His, Jr. (Med. News, May 11, 1901).

W. Gilman Thompson (New York Med. Jour.) gives the following directions for the disinfection of the excreta: A solution 1 to 500 of corrosive sublimate, rendered acid to prevent the formation of albuminate, is a powerful disinfectant, but has an injurious effect on the plumbing. A 10-per-cent. solution of carbolic acid may be substituted. A half-pint of this may be kept constantly in the bed-pan, which must be covered. After a movement the perineum should be cleaned by a 1 to 2000 solution of corrosive sublimate. In the country the stools should be mixed with saw-dust and cremated or buried in a trench four feet deep. The disinfection of the stools should be continued for three or four weeks after the temperature has become normal.

In the disinfection of excreta chlorinated lime is very frequently employed. A part of a solution of 4 ounces to the gallon is used for each stool. A thorough mixture should be made and allowed to stand fifteen or twenty minutes before it is thrown into the water-closet. The latter should be frequently flushed. A solution of corrosive sublimate and permanganate of potash, 2 drachms of each to a gallon of water, has the advantage of being odorless, but is a strong poison.

The soiled clothing may be disinfected by being first placed in a weak solution of corrosive sublimate and permanganate of potash and afterward subjecting it to boiling in water for half an hour. The solution is made by dissolving corrosive sublimate in water 1 to 16. Take 4 ounces of this to a gallon of water and add to it 1 drachm of potassium permanganate. Of this standard solution 1 fluidounce added to a gallon of water will make it sufficiently strong for the

disinfection of clothing (Shattuck). A 5-per-cent. solution of carbolic acid may be used for the same purpose.

2. Typhoid fever is, no doubt, in the great majority of cases a water-borne disease. This has been proved to a demonstration by the lessened mortality of cities from typhoid after a system of water-works has been introduced and pure water obtained. Bacilli have not only been found in the drinking-water, but their multiplication especially in that containing sewage has been amply demonstrated. It is probable that a small number of bacilli may be sufficient to produce the disease in an individual predisposed to it. The multiplication of germs in impure being so much greater than in pure water shows how necessary it is that, apart from the presence of bacilli, the water should be free from all contamination. The source of supply should be carefully and frequently inspected. It has been abundantly shown in the past that water which is thought to be pure may at any time accidentally become polluted.

The well in country places should be situated at a distance from any source of contamination. It should be deep and protected to prevent the surface-water from running in. Well-water should be occasionally inspected for general impurities as well as bacteriologically.

When water is not pure, boiling and filtering should be recommended. Filtering, such as done on a large scale in London, England, renders water almost free from typhoid bacilli. Boiling will destroy all germs, but will not remove the toxins.

Ice is often the source of typhoid fever, as the bacilli are not destroyed by freezing. It is therefore safer to cool water in a refrigerator than to place ice in it when the source of the latter is not well known.

3. Several epidemics of typhoid fever have been produced by contaminated milk. In all large cities dairies should be inspected to see that the disease does not exist in the neighborhood, that the utensils are cleansed with pure water, while general cleanliness is insisted upon. If milk be suspected to contain bacilli, the danger may be removed by boiling.

The introduction of typhoid germs by oysters would seem to be easily prevented by interdicting or regulating the fattening process for which the oysters are placed in fresh water, when the latter is often impure. Oysters obtained from their beds in the deep sea are not contaminated.

4. Good drainage is an important factor in the prevention of typhoid in cities and towns. There is a direct relationship between the amount of impurity of the soil and the number of cases of typhoid fever. In the cities of Munich and Vienna, when the soil had been saturated with sewage for years, the introduction of pure water from without reduced the mortality to a considerable extent, but it was not until thorough drainage was made that the greatest reduction in the numbers of typhoid cases took place. When the streets and lanes are kept free from garbage, manure, and other impurities the liability to typhoid is lessened. This can be better understood when we know, from the investigations of Martin and others, that the bacilli grow much more rapidly in soil saturated with sewage and that the hot weather of summer is favorable to their growth.

For years typhoid has been looked upon as a filth disease, and it is still equally true that cleanliness is one of the best measures of prevention. It was at one time thought that this disease was caused by defective plumbing. Dried germs may possibly be introduced into a



dwelling in this way. It is, however, probable that a condition of the system may thus be brought about which becomes easily affected. Vaccination against typhoid fever has received much attention from pathologists recently, but clinical application of this measure has been too limited to warrant more than a passing notice.

**General Management of Cases.**—Careful nursing at the commencement and throughout the disease is one of the principal factors. The importance of early treatment is shown by Osler's statistics of the deaths in 229 cases: 9.5 per cent. of the patients died who had been admitted during the first week, 6.2 per cent. of those in the second week, 12 per cent. of those in the third week, and 25 per cent. of those in the fourth week. The danger of moving patients after the first week is recognized by all physicians. Patients are often conveyed with comparative safety a long distance in railway carriages especially fitted up for the purpose.

It has also been clearly established that rest in the recumbent posture is of the greatest importance. A single bed (for convenience in nursing) with a hair mattress on springs should be selected. A rubber cloth should be placed under the sheet and the covering should be light. Two beds may be used in some cases, so that, if necessary, the patient can be moved from one to the other.

If at home, a room should be chosen which is most separated from the remainder of the house and at the same time convenient for the nurse. In cities a back room is to be preferred on account of the street-noises. The patient ought to remain in the recumbent posture all the time. A bed-pan and urinal should be used. The body should be sponged night and morning, the night-dress and sheets changed each day, and soiled cloth-

ing removed at once and placed in a disinfectant solution. The excreta should be carefully disinfected.

In hospitals typhoid-fever patients are frequently placed alongside of those suffering from other diseases. There is no special danger in this so long as the greatest care is taken in the disinfection of the excreta. The fact, however, that nurses often take the disease after attendance upon fever patients, and, further, that it is frequently difficult to induce the ward-tenders, who are not so well educated as the nurses, to be thorough in disinfection would lead one to believe that it is desirable to isolate typhoid patients in hospitals.

The patient should be kept as quiet as possible and his wants attended to with regularity and care. Friends, even those of the family, should not, as a general rule, be allowed to remain any length of time in the room. He should never be left alone even when there is no delirium. He may try to rise, and, if delirium is present, there is much danger. Patients have been known to destroy themselves by jumping from the window.

Fluids, especially cold water, should be given freely to produce a free diuresis, and thus rid the system of poison.

The temperature should be taken at least night and morning and recorded in a chart. The use of a chart is of much importance, because the attending physician frequently gains a much better idea of the case by examination of the chart than by looking over a list of temperatures.

After the subsidence of the fever the sponging should be continued, and followed by gentle massage. During convalescence the patient should be taken out on a stretcher and allowed to spend many hours in the open air.

**DIET.**—The powers of digestion are

much diminished, and it is not only useless, but harmful, to give food which will pass through into the intestine without undergoing the normal changes in the stomach, and may act as a direct irritant on the mucous membrane and at the same time undergo fermentation and decomposition, thus increasing the gas in the intestine and producing poisons which may be taken into the circulation. For this reason even liquid nourishment should be given in limited quantity. Milk is altogether the best food, and should form the principal diet of typhoid patients. Lime-water, barley-water, and rice-water are sometimes added to prevent dense curdling in the stomach. Peptonized milk, koumiss, or matzoon may be given. From 3 to 5 pints of milk may be given daily. Clear soups, jellies, broths, and eggs—raw or soft boiled—may also be given. In occasional cases milk is not tolerated by patients, and other forms of nourishment may be substituted for it. Want of tolerance is often a fancy of the patient, and, when milk is perseveringly given, dislike to it ceases. Patients are, however, met with now and again with whom milk does not agree. For such, soups, jellies, barley-water, rice-water, fresh eggs, chicken-broth, mutton-broth, and coffee with much milk may be given.

The digestive functions seem less affected when the temperature is not high, and in mild cases many of these simple foods can be given without danger. Coffee or chocolate with a large proportion of milk is recommended by some in the early part of the day.

During twelve years, from 1886 to 1897, 380 cases of typhoid fever came under the writer's personal care. Of those from 1886 to 1893, 235 patients were treated under a milk diet, with a mortality of 10 per cent., and from 1893 to 1897, 147 cases were treated under a much more extended diet with a mor-

ality of 8.1 per cent. In the latter series water was used more efficiently, but the extension of the diet did not prove injurious. "My plea is simply for treating the patient rather than the disease, for feeding him with reference to his digestive power, rather than solely or mainly with reference to his fever." The following typhoid diet given: 1. Milk, hot or cold, with or without salt, diluted with lime-water, soda-water, Apollinaris, Vichy; peptogenic and peptonized milk; cream and water (*i.e.*, less albumin); milk with white of egg; slip buttermilk; koumiss; matzoon; milk-whey; milk with tea; coffee; cocoa. 2. Soups: beef, veal, chicken, tomato, potato, oyster, mutton, pea, bean, squash; carefully strained and thickened with rice (powdered), arrowroot, flour, milk or cream, egg, and barley. 3. Horlick's food, Mellin's food, malted milk, carni-peptone, bovine, and somatose. 4. Beef-juice. 5. Gruels: strained cornmeal, crackers, flour, barley-water, toast-water, albumin, and water with lemon-juice. 6. Ice-cream. 7. Eggs, soft-boiled or raw; eggnog. 8. Finely-minced lean beef; scraped beef. The soft part of raw oysters. Soft crackers with milk or broth. Soft puddings without raisins. Soft toast without crust. *Blanc-mange*, wine-jelly, apple-sauce, and macaroni. T. C. Shattuck (Jour. Amer. Med. Assoc., July 11, '97).

Coffee, tea, thin gruel, eggnog, clear soups, koumiss, and soft-boiled eggs are among the articles of food which should be permitted patients, even at the height of the disease. The urine of patients subjected to cold baths is greatly increased in toxicity, the kidneys being stimulated by the nervous system. Toxæmia is less common in these patients. Intestinal antiseptics may be added to the bath treatment. F. G. Finlay (Montreal Med. Jour., vol. xxviii, No. 2, p. 96, '99).

The aim should be to give the maximum of food that will sustain the patient, not the maximum amount that he can take. A good diet-list is: Milk, broths, soft-boiled eggs, junket, custard, the soft part of raw oysters, milk-toast, scraped chicken, scraped beef, chicken and rice boiled to a jelly, sago, tapioca,



cornstarch, and animal jellies. The effects should be carefully watched. A. H. Smith (*Inter. Med. Mag.*, Apr., 1900).

The return to solid food in the stage of convalescence must be made with care, especially when the attack has been severe. Boiled custards, eggs lightly boiled, eaten with a small piece of thin bread and butter, are to be permitted first.

Some authors state definitely that solid food should not be given until a week or ten days after the temperature has remained normal throughout each day. Such rules should not always be adhered to. There are cases in which a moderate rise of temperature may exist for weeks, due largely to weakness, exhaustion, and want of elimination. The administration of solid food in small quantities will often relieve the exhaustion and enable the patient to gain sufficient strength to get out of bed. The writer is of the opinion that the general weakness from typhoid is unnecessarily prolonged in such cases by the withholding of solid food. The fact that patients frequently suffer from a relapse after taking solid food may be explained on the ground that in a certain proportion of cases typhoid fever is a relapsing disease, and that the latter may not be due to the change of diet.

A more liberal diet in typhoid fever tried in 150 cases treated in seventeen months. In 84 cases defervescence was apparently unaffected by food. Five were first fed increasingly when the temperature reached normal, and was followed by slight irregularities in the temperature. In 39 cases feeding was begun when the temperature reached normal, and there was no subsequent rise. In 21 cases it was begun before the temperature reached normal, and was followed by a "relapse-like" rise of temperature. In 13 cases feeding was begun before the temperature reached normal and was followed by irregular fever, thought to be

relapse. G. W. Moorehouse (*Boston Med. and Surg. Jour.*, Nov. 15, 1900).

The writer, along with other French authorities—Albert Robin, for instance—has long been an opponent of the use of antipyretics in febrile processes. The predominating factor of typhoid fever is a paresis of all organic functions, and hyperthermia is not deemed a causative factor of the morbid effects ascribed to it, but itself a consequence of this paresis. The latter is primarily due to the influence of the infected blood upon the nervous system.

A free use of beverages is advocated, at least a quart of liquid being administered in the twenty-four hours. Milk is given the preference, owing to its nutritive and diuretic attributes, and may be drunk freely, as much as five pints a day being allowed by the writer wherever possible. It may be given in its normal state or boiled. If such free use of beverages should be objected to by the patient, enemata of boiled water or milk, repeated several times during the twenty-four hours, should be administered in order to at least compensate for the quantity of beverage refused. Patients usually crave fluids, however, and compensative measures are seldom required. Liégeois (*Jour. des Prat.*, Dec. 13, 1902).

**STIMULANTS.**—Alcohol is given by some in a routine way in all cases. The practice should certainly be condemned. Alcohol, like other drugs, produces different effects on different persons, and it is not known how much digestion and assimilation may be interfered with, especially in patients who have been quite unaccustomed to its use. In the mild form of the disease alcohol is unnecessary, patients doing better without it.

In severe forms, especially when patients have been in the habit of drinking, also to old and feeble persons, alcohol may be given in moderate quantities, commencing about the middle of the second week after the headache has subsided. When there is great prostration,

this remedy is of positive benefit, when, for instance, the pulse is frequent and feeble and ataxic symptoms are present. It may be then given in from 8 to 12 ounces in twenty-four hours. It is doubtful if such large quantities as 1 ounce every hour is ever of any real benefit. There is too great a tendency to depend upon this agent to the neglect of other means of restoring the strength. Ether given subcutaneously will sometimes revive a patient temporarily. Alcohol may be given in the form of brandy or whisky, diluted with water, or in milk-punch. Wines, especially champagne, may be ordered when there is irritability of the stomach.

Water internally and externally lessens or mitigates the effects of toxæmia, to a far greater degree than any form of treatment thus far employed. The necessity for stimulants is also lessened in a degree by prompt treatment of diarrhoea, which contributes to exhaustion. When toxæmia is manifest by excitement,—active delirium, flushed face, injected eye, restlessness, twitchings, delusions, etc.,—stimulants are to be avoided and applications of cold are of utmost service. The only drug of service is opium. Five or 10 minims of the deodorized tincture of opium every three or four hours has acted happily in most cases under the circumstances. When, however, the toxæmia is manifest by adynamia,—dullness, stupor, subsultus, frequent dicrotic pulse; hot, dry skin; dry, brown tongue; scanty secretions, and muscular weakness,—the employment of stimulants is imperative. They should be used in small doses at long intervals, but should be increased or decreased in amount and in frequency with the symptoms. If the tongue becomes moist, the delirium lessens, peaceful sleep ensues, and the kidneys become more active, our stimulation is successful. If the symptoms are aggravated, notably the delirium increased and renal secretion lessened, we must proceed more cautiously and employ other than alcoholic

stimulants. It is better at first to err with too little than with too much stimulation. If alcohol is noticed on the breath one hour after its imbibition, the patient is getting too much. The best guide as to the good effects of stimulation is seen in the renal secretion. If this keeps above 50 ounces in twenty-four hours, plenty of water being used internally, no anxiety need arise, and, if 60 to 100 ounces is secreted, the prognosis is good. Musser (*Ther. Gaz.*, Apr. 15, 1900).

**Medicinal Treatment.**—A number of different remedies have been used as specifics; such, for instance, as iodine and calomel, as recommended by Liebermeister. Iodide of potassium, quinine, digitalis; coal-tar derivatives, turpentine and sulphurous acid; and sulphocarbolates have all had their advocates, and have, after a time, been discarded; some as simply useless and others as more or less dangerous. At the present time, in addition to the general management already detailed, cases of typhoid fever are, as a rule, treated according to one of four different methods:—

1. The expectant method, by which is meant the treating of symptoms as they arise and the guiding of the cases safely through the disease. This plan is to be recommended in mild cases when the temperature does not rise, as a rule, over  $102^{\circ}$ , and when the poison seems to exert little effect on the degeneration of tissues. It has, however, been abundantly proved by statistics that the expectant method is inadequate for the successful treatment of severe forms of the disease, and that the mortality under its use is greater than that under some other modes of treatment.

2. The antiseptic method is based upon the fact that germs and toxins exist in the intestinal canal which may be taken up into the system and produce



some of the serious muscular and nervous symptoms. In the later stages of typhoid fever the bacilli are found in large numbers in the bowel-contents, and it is probable that in some cases there may be a mixed infection and the colon bacilli may become more virulent than under ordinary circumstances. The antiseptics which have been the most generally used are bismuth, salicylates, betanaphthol, sulphurous acid; chlorine, as recommended by Yeo; salol, boric acid, and turpentine.

Guaiacol carbonate (Med. and Surg. Bull.; Dom. Med. Jour., '97) is absolutely non-poisonous, 90 grains having been given without causing any symptoms of intoxication. Putrefactive processes alone render it absorbable, and it appears to be more thoroughly absorbed when given in small doses. It has no direct influence on the temperature.

Attention is called to the efficacy of chlorine in the treatment of typhoid fever. After four years of observation, the conclusions presented in a former paper are reiterated: 1. That in the treatment of typhoid fever chlorine can be safely administered until complete disinfection of the alimentary canal is obtained. 2. Under its use the tongue becomes cleaner, the appetite and digestion better, the fever lower, and the stools devoid of odor save that due to chlorine. 3. The general strength, intellectual processes, and nervous conditions improve. 4. The disease is shortened in duration and the patient usually proceeds to a rapid and complete recovery. Wilcox (Med. News, Feb. 11, '99).

Many eminent authorities, Osler and Wilson among others, look upon intestinal antiseptics as useless.

Wilson states that intestinal antiseptics, in so far as new pathogenic organisms are concerned, are directed against germs which do not exist in the bowel prior to the breaking through of the in-

testinal lymph-vessels, and are, therefore, largely inoperative. This may be quite true, but in the latter stages it would seem rational to render aseptic, if possible, the fluids which are in constant contact with the ulcerated surfaces and which contain both germs and toxins. If remedies can be given which do not affect the patient and which change the character of the passages from an ill-smelling liquid to one which has little or no odor, the effect cannot be other than beneficial.

3. The eliminative treatment, which is usually combined with the antiseptics just described, has been advocated by Bouchard in France and by many on this continent.

Eliminative treatment used in 20 patients without a death. Treatment begun by giving the patient a capsule—containing calomel,  $\frac{1}{2}$  grain; guaiacol carbonate, 2 grains; podophyllin,  $\frac{1}{20}$  grain to  $\frac{1}{40}$  grain—every two hours for twenty-four to forty-eight hours, according to the condition of the bowels, and continued until four or five intestinal evacuations occur for two successive days. The calomel is then stopped, and  $\frac{1}{2}$  grain of menthol added to the guaiacol and podophyllin. Small doses of salts or Hunyadi water are given if there is a tendency to constipation. Decinormal salt solution is given per rectum when the skin and kidneys fail to act properly. T. Virgil Hubbard (Med. News, July 21, 1900).

Thistle, of Toronto, introduced some five or six years ago a form in which purgatives were more freely used than had been previously advocated, at least in late years.

In a more recent paper Thistle makes the statement that the adoption of the eliminative plan of treatment lowers the mortality of typhoid fever to a remarkable degree. It also lessens the severity of the symptoms and the duration of the fever.

Statistics of the Toronto General Hospital are given showing the number treated for four years from 1893-97 to have been 563, with a mortality of 6.57 per cent. The mortality for eight years including these four is over 10 per cent. During the four years a large number were treated on the elimination plan, some on the expectant plan, and perhaps a fifth by cold baths. Thistle has had so far under his observation 51 cases, with 1 death from pneumonia. He has collected 190 cases treated by physicians in the Province of Ontario, with 4 deaths: 2 from hæmorrhage, 1 from pneumonia, and in 1 the cause was not known.

A series of therapeutic experiments were made to determine the value of calomel in typhoid fever. In 71 cases calomel was given in a dose of  $4\frac{1}{2}$  grains thrice daily, while, for the purpose of comparison, quinine was given in the same doses in 40 other cases. The patients in the first group continued to take the calomel till their evening temperature became normal; this result was obtained after a total amount of the drug varying from 2 to 5 drachms had been taken. Stomatitis never occurred, nor was diarrhœa aggravated. The disease in all these patients was mild in type, and often aborted. The fever abated more quickly, and the mortality (2.82 per cent.) was less than in the cases treated with quinine. No patient who was put on the calomel treatment, within the first week of the illness, died. Although calomel is not a specific, it is a most useful remedy in typhoid fever. Andrievsky (Sem. Méd., Dec. 28, '98).

The Woodbridge treatment is similar to that of Thistle, the object being to render the contents of the bowel aseptic by free elimination. Whatever may be the theory upon which the eliminative treatment is founded, the writer, from personal observation, is satisfied on two points:—

1. That, in a number of cases, the

temperature falls to normal or nearly so within twenty-four hours after free purgation is induced.

2. That cases at the end of the second or in the third week, when the patients are in a low toxæmic condition,—as shown by the dry, cracked tongue; sordes; low, muttering delirium; and meteorism,—have experienced decided and favorable change within twenty-four hours after free purgation. The writer is quite aware that such practice may possibly tend to the onset of hæmorrhage, but he considers the danger from the latter to be less than from the poisoned condition of the system.

**Hydrotherapy.**—The cold-bath treatment, as it is carried out in well-appointed hospitals, is probably the best form of treatment known, and if all patients could be treated in this way there would be little use of adopting any of the other known methods.

The remarkably-small mortality of three out of ninety-nine cases treated in the Johns Hopkins Hospital is an evidence of this. Every practitioner of experience knows, however, that many cases in private practice cannot be treated with cold baths. It is often impossible to induce patients to go to a hospital, and it is therefore necessary to treat them at home, even if the surroundings are unfavorable. Then, again, in country districts this method is, in many cases, quite impossible. When an epidemic spreads over a large section the procurement of baths, nurses, etc., would be quite an impossibility. Some other method of treatment must, therefore, be devised, and the antiseptic method with moderate elimination has so far been the best.

It is, no doubt, true that the cold-bath treatment might be adopted in many private houses where it is not now used if the attending physician were more firm



in its advocacy and had more faith in the great benefit of this mode of treatment.

[Dr. W. H. Thomson (Med. News, '97) gives the following treatment adopted in the Roosevelt Hospital. If a patient is admitted before the end of the second week of the fever, 5 grains of calomel and 35 grains of compound jalap-powder are administered on three successive nights. The calomel treatment is discontinued after the eighteenth day of the disease on account of the liability to hæmorrhage. Ten grains of saccharated pepsin with 10 grains of carbonate of bismuth are given every three hours to prevent tympanites and diarrhœa. If the latter persists, a double dose of bismuth is given. Whenever the tongue begins to be dry at the tip, 15 drops of oil of turpentine are given in emulsion every six hours. Moderate doses of strychnine and caffeine are sometimes given for cardiac debility, but never digitalis.

The cold bath is resorted to as soon as the temperature reaches 103°. The patient is actively rubbed in the bath and is taken out when the temperature falls to 101°. J. E. GRAHAM.]

The cold-bath treatment of fever was employed by Curry, an English ship-surgeon, in the latter part of the last century, and it was first systematically introduced for the treatment of typhoid fever by Brandt, in 1861. I first saw the cold-bath treatment used in 1870, when it was adopted in the German army. This method is constantly growing in favor. It should not, however, be used for old and feeble persons or for those who have weak hearts or for excessively nervous individuals who struggle each time they are put into the bath. Baths are contra-indicated if peritonitis or hæmorrhage is present. The following description of the method adopted in the Johns Hopkins Hospital has been kindly given to me by Dr. T. McCrae, who has had recently more immediate charge of the typhoid cases:—

The baths are given every three hours

while the temperature is 102° or 102 1/2° or over. The interval is measured from the time the patient is put into the tub. The patient remains in the bath twenty minutes. The temperature of the first two or three baths is 80° or 85° and in a robust adult the subsequent baths are given at 70°. But in cases where that temperature is not well borne or when the patient is delicate or perhaps advanced in the disease before admission, the temperature may remain at 80° or 85°. There is no lowering of the temperature by ice. The patient is placed in the bath and no further attention is paid to the temperature of the water. A bath with reduction of temperature—say, from 95 to 80—is rarely given, and only in special cases. The temperature of the bath for children is generally 80, and they are left in from ten to fifteen minutes.

Careful judgment is to be employed in giving the bath to children. Some do not bear the plunge at all well. There is, as a rule, at no period of childhood the need to use water at as low a temperature as in the case of adults. At the Children's Hospital of Philadelphia it is the custom to employ the graduated bath, placing the child in the tub with the water at a temperature of 95° and cooling it down to 85°, or occasionally, with older children, to less than this. Very frequently, sponging answers every purpose. Even a tepid bath may sometimes answer well. Hydrotherapy is not to be used as an unalterable plan of treatment. J. P. C. Griffith (Phila. Med. Jour., Oct. 15, '98).

Tepid-bath treatment of typhoid fever used instead of the cold bath in the fever-wards of the Brisbane Hospital. As the result of many thousands of baths, the following conclusions are warranted: 1. The average fall of temperature obtained through these baths is 1.5° to 2° F. 2. In a large number of cases a bath of 85 degrees will bring about a greater reduction than one of 80 degrees of the same duration. 3. In a small number of pa-

tients (principally the aged, the weak, and children) a bath of 90 degrees is more effectual than one of 85 degrees. 4. There are a few cases that offer considerable resistance to refrigeration through tepid baths. Hirschfeld (*Ther. Gaz.*, May, 1900).

The nervous system of the child responds more quickly and energetically to the cool bath than does that of the adult, and to some extent in inverse proportion to the age. It is therefore undesirable that as low temperature should be employed in the case of a young child as in the case of an adult. A bath of 90 degrees cooled to 85 degrees and repeated regularly for the first few days gives rise to neither resistance nor shock nor collapse. Later on lower temperatures may be employed if necessary. A. D. Blackader (*Archives of Pediatrics*, Sept., 1900).

In the treatment of typhoid fever hydrotherapy has attained its greatest reputation. Professor Vogl, medical director of the Bavarian army, furnishes a record of 8325 cases of typhoid fever treated in the course of 47 years in the Hospital at Munich, showing a reduction in mortality from 20 per cent., under the expectant plan of treatment, to 2.7 per cent. by the cold-bath treatment. He shows that intestinal hæmorrhage, perforation, peritonitis, pneumonia, and other complications have been greatly reduced. Brand published a record of 5573 cases with a mortality of 3.9 per cent. Jurgensen published the records of the hospital at Kiel. From the year 1850 to 1861 330 cases were treated under the expectant plan, with a mortality of 27.3 per cent. From 1863 to 1866 160 cases were treated by the Brand method, with a mortality of 3.1 per cent. All these men insist that the Brand treatment, to be successful, must be rigorously carried out. They do not claim that it is a universal panacea. The duration of the disease is shortened, only in so far as complications are avoided. But the patient is left stronger than after the expectant plan of treatment, and convalescence is more rapid. As an antipyretic it is safer than drugs. The Brand method, as carried out in most of the large general hospitals, is as follows:—

Every three hours, if the temperature be 102.5° F. or over, the patient is placed in a bath, which has been wheeled to the bedside. The temperature of the water is about 70° F. The head is supported and cold water is poured over it, while general friction is applied to the body. The patient remains in the bath from fifteen to twenty minutes and is then removed, wrapped in a dry sheet, covered with a blanket, and put in bed. He is then given a stimulant. Neither bronchitis nor pneumonia is considered to be a counter-indication. J. A. Shields (*Brooklyn Med. Jour.*, March, 1902).

PREPARATION. — The night-dress and bedclothes are removed under a sheet by which the patient remains covered. If he is sweating, he is rubbed dry. The bath-tub is filled outside of the ward to within six or eight inches of the top.

Canvas strips are used to support the patient in the tub. These are thirty-six inches long and of a width varying from eighteen to thirty inches. They are fastened across the tub to the edges of the bath by clamps which are easily removed. The canvas strips are placed so as to form a sort of trough in which the patient lies. Their exact arrangement has to be made after the patient is in the tub. The strip at the head of the tub may be clamped all around the end so as to form a support. Two persons lift the patient covered by the sheet into the bath. The attendant lifting the head slips his hands under the shoulder, and puts the patient's head in the hollow of the arm farthest away from the bath. A second attendant takes the feet, and the patient is directed to hold himself stiff when he is lifted into the tub and lowered gently into the water. The sheet is used as a covering. The strips should be so fixed that the water just covers the patient's chest. The head should be supported on a ring or air pillow. The patient is rubbed regularly, constantly, and systematically either with a bare



hand, a rubber, or a mitten made of lint. The strength used depends on the feelings of the patient, and special attention should be paid to the hands and feet. The rubbing should be continued during the whole time of the bath. A cloth rung out in ice-water is placed on the patient's head before he is put into the bath-tub and should be frequently changed. If pronounced nervous symptoms or high fever are present ice-water is sponged freely over the head whenever the cloth is changed. The bed is prepared before the end of the bath as follows: Over the lower sheet a mackintosh is spread, and on this is put a linen sheet. At the end of the bath the patient is lifted back into bed, a dry sheet is held over the bath and beneath it the wet one is pulled to one side of the patient. He is lifted up as before, held to drip for an instant, and lifted into bed. The sheet is tucked around him, as is also the one that was previously put on the mackintosh sheet. Generally a blanket is put over these; some patients like two blankets. The patient is left in the wet sheets ten minutes, after which he is rubbed dry, the sheets and mackintosh are removed, and the night-dress and bed-clothes are replaced. The temperature is taken one-half hour later. This is called the after-bath temperature, and is recorded. Nourishment is never given in the bath, but usually immediately afterward. Alcohol is not given as a routine practice with the baths. Many cases—in fact, the majority—go through without any. It is frequently ordered only with the baths, and then it may be given either before or after. If alcohol is being regularly administered,—say, every three hours,—it is generally given at bath-time.

The patient is removed at once from the bath if any of the following condi-

tions appear: Extreme distress, dyspnoea, cyanosis, vomiting, or convulsions. There is no routine method; every case has a special order as to bath-time, etc.

A description of the method of giving the baths at the Toronto General Hospital has been kindly furnished me by Mr. Tanner. The details are the same as those already given in almost every particular, except that the water which is at 85 when the patient is placed in the bath is cooled down to 70 by means of ice.

This method of treatment should be commenced as early as possible when the temperature reaches 102.5°. The number of baths given depends on the temperature of the patients. When the baths are given before the fifth day, the mortality is very light, and J. C. Wilson, who has had a very large experience in this method of treatment, found that, in a series of 132 consecutive cases treated before the fifth day, the mortality was about 3.4 per cent.; in those between the fifth and tenth day, 7.7 per cent.; and in those after the tenth day, 22 per cent. In the latter cases the mortality would, under any circumstances, be high, because the early treatment would probably have been injudicious, and the removal from one place to another is always dangerous in advanced cases. Wilson gives the baths when intercurrent diseases, such as bronchitis and pneumonia, are present. Menstruation and pregnancy do not contra-indicate the use of baths. The mortality in 524 cases under Wilson in the German Hospital up to January, 1896, treated by cold bathing was 7.25 per cent. In the Johns Hopkins Hospital 652 cases were treated under Osler's directions up to January 1, 1898, according to Brandt's system, with a mortality of 7.1 per cent. Perforation and hæmorrhage are not increased by bathing, but there is a greater number of relapses.

The benefits arising from cold baths are due to the reduction of temperature, the improved condition of the nervous system, and the more rapid elimination of toxins by the urine.

*Résumé* of 1211 cases of typhoid published, in all of which cold baths were used from the beginning. There were 12 deaths; that is, about 1 per cent. From these 12 fatal cases 2 should be eliminated, in 1 of them the treatment having been suspended upon the sixteenth day on account of arthritis, and the other terminating fatally from some unknown cause. Paul Chéron (*L'Union Méd.*, May 24, '88).

[The mortality of typhoid cases in Chickamauga Park, treated according to the Brandt system, was 6.25 per cent. (*Phila. Med. Jour.*, Sept., '98). J. E. GRAHAM.]

A good deal depends upon the time when the treatment is begun. Of 32 cases treated before the fifth day there was a loss of but 1, or 3.4 per cent.; of 78 treated before the tenth day there was a loss of 6, or 7.7 per cent.; 18 cases receiving the treatment after the tenth day, there was a loss of 4, or 22 per cent. James T. Whittaker (*N. Y. Med. Jour.*, Jan. 14, '99).

Death from perforation and hæmorrhage is more frequent under the Brandt than under other methods of treatment. Relapses, however, are not more frequent under the Brandt treatment. Of 408 personal cases relapses occurred in about 8 per cent. Hæmorrhage was the cause of death in three. Stewart (*Montreal Med. Jour.*, Feb., '99).

Statistics of 1904 cases treated by the Brand method, or the same somewhat modified. Conclusions: The treatment does not avert or diminish the frequency of hæmorrhage, but the frequency of perforation is reduced. It diminishes the danger of complications, especially those relating to the circulatory and respiratory tracts. The treatment is attended by albuminuria in a large percentage of cases. Purgatives are administered early in the attack, calomel being used in fractional or large doses, sometimes followed by a saline. Drugs are used as each case

requires, but only about 10 per cent. of the cases require any medication whatever, except the early purgatives. Instead of having patients lifted into the tub beside the bed, those who can do so are encouraged to help themselves. Then a stationary tub is placed at the end of the ward and the patients, with assistance, walked every three hours to the bath and back to the bed. This procedure was found to exert a very favorable influence upon the course and symptoms of the attack. The mortality was 7.5 per cent. J. C. Wilson and J. L. Salinger (*Phila. Med. Jour.*, Mar. 3, 1900).

Results in 1019 cases treated by the cold-bath method in the medical clinic of Freiburg-in-Breslau. The mortality was 9.32 per cent.; but excluding cases which were moribund on admission, 7.9 per cent. Baths act not so much by lowering the temperature as by improving general nutrition, through the circulation and nervous system. Several factors influence the circulation; the peripheral vessels contract; the difference between the arterial and venous blood-pressure, on which depends the rate of flow in the vessels, is accentuated, and the heart is stimulated mechanically; at the same time the respirations become deeper. Whether the bath treatment has any influence on the mortality from intestinal perforation is not known; but as to mortality from hæmorrhage it has almost certainly none. Apart from intestinal lesions, the greater number of deaths were due to pulmonary complications, though bronchial catarrh was certainly less common than in cases treated without baths. It was due to descending tracheo-bronchitis from the inhalation of infected material from the upper air-passages. Baumler (*Deut. Archiv f. klin. Med.*; *Brit. Med. Jour.*, June 14, 1900).

**Treatment of Special Symptoms.**—Patients suffering from a mild form of the disease without complications do not need any special medication, and care should always be taken that the stomach is not deranged by drugs unnecessarily given.

The headache in the first week is best relieved by phenacetin in from 3- to 5-



grain doses. The smaller doses are often quite sufficient. Sodium bromide may be given alone or with aromatic spirit of ammonia. The application of the cold-water coil or ice-bags to the head have often a good effect. A dose of calomel followed by a saline will sometimes relieve a headache.

In the early stages sleeplessness is relieved by the administration of trional or sulphonal. In the latter part of the disease opium is altogether the best remedy, and may be given in the form of Dover's powders. Opium has a tendency to prevent elimination, and is, on that account, objectionable. The other nervous symptoms, coma vigil, subsultus, etc., do not often occur in those cases treated by cold bathing. In the adynamic condition, stimulants are especially necessary, and should be given freely. Wilson recommends the administration of hypodermics of ether in 10-minim doses, repeated once or twice at intervals of several hours. He also speaks highly of Siberian musk in nervous depression. It may be given in pill form or in suppositories, 5 to 10 grains to the dose. Valerian and asafoetida are useful when the delirium is of an hysterical character.

Dryness and coating of the tongue and lips may be much relieved by first washing the mouth with a solution of boric acid, followed by the use of honey and borax, if there are any abrasions or ulcers. A very mild solution of potassium permanganate is sometimes used as a mouth-wash. Vomiting may be relieved by the application of mustard over the epigastrium. Bismuth and oxalate of cerium, diluted hydrochloric acid, and cocaine hydrochlorates have been recommended. Aërated water, champagne, and brandy and ice have been given. Attention should be paid to the quantity and character of the food.

Tympanites, when moderate in degree, does not need any special treatment; when excessive the diet should be reduced in quantity, if necessary. Turpentine stupes may be applied. Turpentine, salol, and betanaphthol, with salicylate of bismuth, may be given. The use of a rectal tube will give relief if the gas is in the large intestine.

If the meteorism is so great as to be really dangerous to life, rectal injections of a solution of sulphate of magnesia may be given. Puncture through the abdominal wall is not advisable in any case.

Flushing of the colon advocated: from 1 to 3 quarts of cold water can be easily and safely passed into the colon, which will rapidly lower a high temperature. Tympanitic distension always disappears with the passing away of the water so injected. Buchman (Med. Record, Sept. 28, '89).

Constipation is present in a certain proportion of cases, and, if they are of a mild type, it is probably not harmful. The bowels should be kept free by the administration of salines, castor-oil, or olive-oil: remedies which do not materially increase the peristaltic action of the bowels. If constipation exists in the second or third week, with evidence of severe typhoid poisoning, it is my opinion that the administration of a saline is less dangerous than to allow this condition to continue. It must be stated that men of large experience—Wilson, for instance—advise against the administration of laxative drugs after the middle of the second week. He is also of the opinion that large enemata, especially when given with energy, are not free from danger.

Diarrhoea, unless excessive, does not require any special treatment. It is sometimes the result of local irritation from hard masses and irritating fluids, and a mild cathartic, by expelling these,

will cause the diarrhœa to cease. If it still continues, the writer has found opium and acetate of lead the best remedies.

**INTESTINAL HÆMORRHAGE.**—When symptoms of hæmorrhage appear, the patient should be kept quiet; the foot of the bed may be raised to prevent fainting, and blood which is passed through the bowels should be removed with as little disturbance as possible. All stimulants should be forbidden. Nervousness on the part of the patient will excite the heart and thus tend to increase the hæmorrhage. An ice-bag may be placed on the right iliac fossa. Opium is the best internal remedy, for, while it lessens the peristaltic action of the bowels, it also quiets the patients. Turpentine is thought by some to be especially valuable. Intestinal antiseptics, by reducing tympanites, are of use in hæmorrhage. Normal salt solutions in amounts of from 4 to 6 ounces, may be injected into the subcutaneous areolar tissue. Transfusion of blood is a difficult operation, and in the writer's experience has not been of much value.

The food should be given in small quantities and stimulants avoided. The bowels should be kept quiet for six or eight days. According to Lauder Brunton, lime-water given during the course of the disease may prevent intestinal hæmorrhage.

Case in a female aged 36 years, who had a typical attack of typhoid fever, associated with a broncho-pneumonia, or diffuse bronchitis. This patient recovered from the pneumonia, but developed a typhoid-like rash and a typical typhoid temperature. Two weeks after the onset of the typhoid and one week after the appearance of the roseola, an intestinal hæmorrhage took place, which was treated with ice, opium, bismuth, and ergot. Bleeding was so extensive as to threaten death, and adrenalin was used, 30 minims, in

saline solution, every three hours, with the result of a sudden cessation of the bleeding, either as coincidental or as causative. Graeser (Munch. med. Wochen., vol. i, p. 1294, 1903).

Six cases of hæmorrhage in typhoid fever which were treated by injections of gelatine. Gelatine injections have been employed for some time in the treatment of internal hæmorrhage from various causes, the great objection to their use being the risk of infection with tetanus, and the production of local symptoms and of fever. To guard against the former risk great care was taken to render the patient's skin sterile, and the gelatine employed was made, filtered, and sterilized three times on three successive days. A sterilized syringe was used for the injection. In order to avoid the production of local symptoms, the gelatine was not used in a greater concentration than 20 per cent., the dose being 2 grammes. No infective phenomena occurred in any of the cases, but there was always a certain amount of local swelling, which disappeared in every instance within twenty-four hours. One patient, who was injected five times, had a definite attack of fever on four occasions after the injection. The following results were obtained: In 2 of the cases the hæmorrhage ceased at once after the injections, and did not recur; in 1 it stopped at once but a repetition occurred a month later; in the 3 remaining cases the hæmorrhage continued: in 1 it stopped after repeated injections; in another, cessation occurred spontaneously shortly afterward, and the third patient died on the day following. Präbram (Prag. med. Wochen., No. 20, 1903).

When hæmorrhage occurs and there is a rapid discharge of blood from the bowels, the author found that a half ounce or an ounce of commercial gelatine, dissolved in a pint of water and given in 2 to 4-ounce doses at frequent intervals, will very often have a marked effect in controlling the hæmorrhage. It is more reliable than ergot or the ordinary astringent preparations. E. LeFevre (Merck's Archives, Jan., 1904).



PERFORATION.—This very grave lesion has not been so far treated with much success. A low septic peritonitis usually follows, which is quickly fatal. The usual treatment is complete rest and the administration of opium or morphine hypodermically. Ice may be given for the dryness of the throat, and all food should, for a time, be withdrawn. If an early diagnosis is made, surgical interference is indicated. This procedure is warranted by the success which has so far attended early operative measures. (See STOMACH AND INTESTINES, SURGERY OF, this volume.)

The early diagnosis of perforation has, in one or two cases, been confirmed by making a blood-count and finding a great increase in the leucocytes. Unfortunately, rupture may take place without increased leucocytosis, and the latter condition may arise from other local inflammations when there is no perforation. The operation should be performed as early as possible after the symptoms of shock have passed away. Keen states that the second twelve hours after the accident have been shown by statistics to be the most favorable time. The following statistics, taken from Keen's "Surgical Complications and Sequelæ of Typhoid Fever," show the danger of delay in this operation:—

	Cases.	Recoveries.
Within twelve hours.....	15	4
Twelve to twenty-four hours..	20	6
1 to 2 days.....	13	1
2 to 3 days.....	6	2
3 to 4 days.....	4	0
5 days.....	1	0
38 days.....	1	0

Keen states that if the operation is not done within about twenty-four hours after the accident there is practically no hope of recovery.

Appendicitis may occur as an acci-

dental complication of typhoid fever, and as such bears no other relation to the typhoidal infection. It may appear during the course of typhoid fever and be caused by conditions engendered by both local and general infection by the bacillus of Eberth.

Patients are sometimes met with who are suddenly taken ill with symptoms unmistakably appendicular in character, but which gradually subside and are merged into a typical typhoid, which then runs its usual course.

While the occurrence of an appendicitis in the course of typhoid fever may be accidental or causal, yet it is the third condition mentioned which is most puzzling to the physician, and demands a great deal of care to prevent him from falling into the error of advising an operation upon an appendix situated near, and irritated by, specific lesions in and about the head of the colon. C. J. Aldrich (Cleveland Med. Gaz., Jan., 1901).

The mortality of enteric fever is from 7 to 14 per cent. Of the fatal cases, 50 per cent. of the deaths are due to asthenia, 25 per cent. to perforation, and 25 per cent. to hæmorrhage and other accidents. Of the deaths which are due to perforation, by means of early operation after an early diagnosis, between 30 and 40 per cent. may be saved. Out of 11 cases operated upon in the Johns Hopkins Hospital since January 1, 1900, 5 recovered. Osler (Lancet, Feb. 9, 1901).

A few brief points as to management of cases in which operation is indicated. A patient cannot be moved to a hospital for operation. If in a private house, this must be done at the bedside. Every effort must be made to save time in operating. There must be no handling of distended bowel outside the abdomen. Once escaped this cannot usually be returned without an amount of trauma which is most fatal. Inflamed visceral peritoneum splits and peels off with the greatest ease. A short incision of the bowel made under constant irrigation is by far the less of two evils, and may be quickly and safely repaired. An intestinal leakage has already occurred, so

that the additional danger of soiling the peritoneum may be disregarded. The external incision should be located as for appendicitis. The point of departure for search should be the ileo-cæcal junction, as the majority of perforations occur in this neighborhood. If possible, the lateral abdominal wall should be made to form one side of the area packed and drained. Infusion of salt solution is useful as a stimulant. It will tide a weak patient over dangerous periods of depression, and probably also assist in the elimination of typhoid products by the kidneys. The external wound should not be closed. Other things being equal, the patient most likely to recover will be the one to whom the least is done. Even establishing drainage along with a fæcal fistula would be far better than prolonged manipulation, which is sure to kill. G. Erety Shoemaker (Phila. Med. Jour., May 31, 1902).

Perforations are to be expected in about 2.5 per cent. of all cases of typhoid fever. Prompt surgical intervention is the best and only logical treatment. Early diagnosis is most desirable, and will be the means of greatly reducing the mortality, as 55 to 60 per cent. would recover. Diagnosis, sufficiently early to achieve these results, can only be made by careful watching, treating all cases as serious ones and a proper interpretation of the early, even the preperforative, symptoms, the suggestions of Cushing as to this stage being of value. At the first indication of this stage a surgeon should be consulted and preparations made to operate. The sphygmomanometer should come into general use as an important aid to diagnosis. More cases die from delay than from errors in surgical technique. Therefore, in doubtful cases, though a mistake may be made and no perforation found, operation should take place. No case, unless dying, is so desperate as to be beyond some hope of saving. So no time should be lost in operating and the cavity should be drained. The abdomen should be gotten into quickly, and out of more quickly. Louis Frank (Journal American Medical Association, April 2, 1904).

Epistaxis, as a rule, requires no special treatment. The application of ice to the nose or the use of a weak solution of tincture of iron will often be sufficient. It is occasionally necessary to plug the posterior nares. Styptics, such as gallic acid and tannic acid, are of doubtful value when given internally, and may derange the stomach. The lungs should be frequently examined to ascertain the presence of bronchitis or pneumonia. Hypostatic congestion may, to some extent, be prevented by changing the position of the patient every few hours. The presence of pneumonia should not deter the physician from pursuing the ordinary course of the treatment of the fever. Expectorants containing ammonium chloride may be given for the bronchitis.

The heart should be frequently examined, and, if it is weak, tonics, such as strychnine and caffeine, may be given. The nitrites, especially amyl-nitrite, have been recommended by Wilson. In cases of cardiac weakness care should be taken that the patient does not sit up or make sudden movements in bed.

The retention of urine is a not infrequent complication, and when the patient is very weak the physician should carefully examine the abdomen for distended bladder. A soft-rubber catheter should be used, and the greatest care taken by thorough cleanliness to prevent the introduction of germs into the bladder. Immediately before the use of the catheter the part should be washed with a bichloride solution, 1 to 2000.

A continuously-high temperature is very injurious to the patient. If cold baths cannot be given, cold sponging, cold compresses, Leiter's coil, or the ice-bag may be used.

Antipyretics—such as antipyrine, antifebrin, and guaiacol—are to be condemned. The writer has seen two cases



in which very alarming symptoms followed the taking of a 15-grain dose of antifebrin. Both patients had been strong and healthy persons previous to the onset of the fever.

**Treatment by Inoculation.**—Within the last few years attempts have been made to shorten the course of typhoid by subcutaneous injections of sterilized liquid from the cultures of typhoid bacilli.

Fraenkel and Manchot ("Amer. System of Med.," vol. ii, p. 229) used a sterilized liquid from the culture of typhoid bacilli in bouillon made from the thymus of the calf and heated to 60°. The injections were made deeply into the muscles of the buttock. The first injection—0.5 cubic centimetre of the sterilized liquid—was not followed by any reaction except in children. On the following day a second injection of 1 cubic centimetre was made, which was followed, in the majority of cases, by rise of temperature and chilly sensations. After six or seven hours the temperature fell and rose again in those cases in which the treatment was discontinued. Fraenkel gave the injection every second day, increasing the dose by 1 cubic centimetre each time. The temperature showed decided remissions. The constitutional symptoms were less marked, and complete absence of fever resulted in the course of a few days. Fifty-seven cases were treated in this way.

Rumpf publishes the results of the treatment of thirty cases with a sterilized culture of the bacillus pyocyaneum obtained from thymus bouillon. Favorable symptoms followed its use.

Beumer and Peiper employed 1-per-cent.-pepton bouillon as a culture-medium, and destroyed the bacilli by exposure to a temperature between 55° and 60° C. for an hour. Longer exposure or

a higher temperature decidedly decreased the virulence of the culture. Sheep were inoculated with these cultures at intervals, the amount injected being gradually increased from 1 to 100 cubic centimetres. The animals were then bled, and the serum treated with 0.5-per-cent. solution of carbolic acid and preserved in a dark place. The serum was found to possess both immunizing and curative properties. No dangerous effects followed the injection in healthy men, but further experimentation is necessary to establish its immunizing and curative effect on human beings.

Review of Wright's observations of typhoid among inoculated and uninoculated in the British Indian Army. Period of observation, about nine months; total number of men under observation, 11,295; number inoculated, 2835; number not inoculated, 8460; number of cases of typhoid among inoculated, 27, or 0.95 per cent.; number of cases of typhoid among uninoculated, 213, or 2.5 per cent.; number of deaths from typhoid among inoculated, 5, or 0.2 per cent.; number of deaths from typhoid among uninoculated, 23, or 0.34 per cent. McLauthlin (Med. News, Mar. 2, 1901).

Results of antityphoid inoculations in Egypt and Cyprus during the year 1900. Of a total number of 2669 uninoculated and 720 inoculated soldiers, 68 of the former and 1 of the latter contracted the disease. The proportion, therefore, was 2.50 to 0.14 of incidence. The reduction was nineteenfold. A. E. Wright (Brit. Med. Jour., May 4, 1901).

A review of the statistics of the various hospitals of Paris, omitting that under the direction of Dr. Chantemesse, showed that the combined mortality from typhoid fever was 19.3 per cent. While there were naturally variations, the lowest recorded mortality in any hospital exceeded 12 per cent. In the hospital in Dr. Chantemesse's charge, where serum-therapy was adhered to in every case, there were but 7 deaths out of 186 patients—a mortality of 3.7 per cent. Other

treatment employed was practically the same in all the hospitals. Three out of the 7 deaths were due to perforation, 1 to purulent peritonitis, and 1 to intestinal hæmorrhage. All these patients came under treatment late in the disease. Chantemesse has noted no complications in patients coming under treatment early. So necessary does he consider immediate serum-injections that he gives them even before the diagnosis is certain, for 2 cubic centimetres can do no harm. So far in Paris 356 patients have received this serum-treatment, with but 17 deaths—a mortality of 4.7 per cent. At Toulon, out of 151 patients treated, 13 died. Adding this, the mortality was 6 per cent. The German army statistics, always held up as a model in France, give a mortality of 9.5 per cent. in typhoid fever. Chantemesse explains the effect of this serum in that it is not only both anti-infectious and antitoxic, but, above all, it excites phagocytosis. Thus it is almost specific in typhoid fever. Besides, he calls attention to the necessity of isolating typhoid-fever patients for the protection of other patients. This he considers an important means of prophylaxis. *Editorial (Phila. Med. Jour., Jan. 24, 1903).*

**Convalescence.**—Patients should not be allowed to get out of bed until they are sufficiently strong to make the change with safety. I have always allowed patients to sit up and to move about in bed, two or three days previous to their sitting in a chair. The dressing of patients often produces more fatigue than sitting up, and a dressing gown only should be allowed at first. In some the strength returns very slowly, and a recrudescence, with slight elevation of temperature lasting two or three days, is not unusual. Strychnine, iron, and arsenic are indicated in cases of anæmia and cardiac asthenia.

It is not necessary to cut the hair short in typhoid fever, but when the system of cold bathing is adopted it is more convenient to do so. Peripheral neuritis,

producing paraplegia, is treated by tonics, local massage, and the use of galvanic and faradic currents. Typhoid spine, which has been alluded to, is best treated by supporting measures and the local use of the thermocautery.

Thrombosis of the veins of the leg is often a troublesome sequel of typhoid fever. The patient should remain in bed until the local pain and swelling have disappeared. Iodine may be applied over the affected veins. In many cases careful bandaging is necessary after the patient gets up.

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### TYPHUS FEVER.

**Synonyms.**—Typhus gravior; camp-fever; ship-fever; spotted fever; exanthematous fever.

**Definition.**—An acute infectious febrile disease, commencing abruptly, continuous in type, reaching its crisis in about two weeks, accompanied by maculated or petechial spots on the surface and prominent nervous symptoms.

**Symptoms.**—The period of incubation is between seven and fourteen days, at the end of which time the patient is attacked rather abruptly with pains in the head, back, and limbs, accompanied by a decided chill or alternations of heat and cold, which soon give place to decided fever-heat. The face becomes flushed, the skin generally dry and red, the vessels of the conjunctiva injected, and the temperature high. The tongue is usually covered with a white coat, the mouth dry, pulse frequent and moderately full, bowels inactive, and urine high colored and less abundant than natural. There is much restlessness and sense of prostration, or mental dullness with indications of delirium. All the symptoms usually increase during the first week, reaching their climax in from



five to seven days. The temperature advances with but little or no morning remissions from 103° F. on the first day to 104° or 106° F. on the fifth or sixth day, after which it recedes one or two degrees each morning, but returns to the higher grade in the afternoon and evening.

During the same period of time the tongue becomes more thickly covered with a dry, brown coat, some sordes appear on the lips and teeth; the pulse increases in frequency, often reaching 120 to 130 per minute, though less full. The respiratory movements increase in frequency, with less fullness, and a dry, congested condition of the mucous membrane of the air-passages is generally present, and in the later stage more or less hypostatic engorgement of the lungs. In a large majority of cases a rash appears on the skin between the third and fifth days of the disease, first over the abdomen and upper part of the chest, then, in two or three days, it extends to the face, neck, and extremities. Many of the spots present a dull-red color and appear as though beneath the cuticle. Other spots are more papular, and in severe cases they become petechial or hæmorrhagic and only partially disappear on pressure. In mild cases the eruption is generally slight, and in some altogether absent. In a few severe cases paroxysms of vomiting and diarrhœa have occurred early in the progress of the disease, but, as a general rule, the stomach and bowels are inactive and the abdomen free from gurgling and tympanites.

In the most severe class of cases the patient becomes early and persistently delirious, the vessels of the conjunctiva are injected, the pupils small, the tongue dry and brown with sordes on the teeth and lips, the skin hot and dry. A copi-

ous eruption of petechial or hæmorrhagic spots appears, the temperature rises to 105.8° or 107.6° F., the pulse to 140 per minute and weak, the cardiac impulse and first sound are weak, respirations frequent and shallow with rapidly increasing hypostatic engorgement of the lungs. The urine scanty and albuminous. Sub-sultus tendinum is marked. Such cases generally terminate fatally before the end of the first week. In a larger number of fatal cases these unfavorable symptoms develop more slowly and do not end in death until the end of the second week or the first half of the third. When the patient is progressing toward recovery the patient's mental condition is more that of dullness and light delirium, from which he can be more readily aroused especially during the morning hours, when the temperature is a little lower and the pulse less frequent, and the renal secretion more natural. Such cases reach the crisis about the end of the second week, when the patient falls into a more protracted and natural sleep, from which he awakes with his mind clear, skin moist, urine free. After one or two evacuations from the bowels, rapid defervescence follows, and in two or three days convalescence is fully established, though accompanied by great prostration.

While it is true that typhus fever is not usually accompanied by active gastro-intestinal irritation, yet exceptional cases occur during almost every epidemic characterized by active diarrhœa and vomiting. On the other hand, cases are occasionally met with in which constipation requiring the use of laxatives persists throughout the whole course of the disease. Such cases are generally characterized by much delirium or stupor and subsultus.

**Diagnosis.**—The diseases with which

typhus fever has been most frequently confounded are typhoid, or enteric fever; cerebro-spinal, or spotted fever; malignant rubeola, and some cases of acute miliary tuberculosis. The fact that, through all the centuries prior to about the middle of the present, all cases of what are recognized now as typhoid and typhus fevers were regarded as only varieties of one type of continued fever is sufficient evidence of a close similarity in the clinical phenomena presented by them. The chief clinical diagnostic features are that in typhus the prodromic stage is short; the chill or cold stage is more marked, followed by a more rapid rise of temperature without morning remissions during the first week, and a more marked crisis near the end of the second week. The pulse is more frequent; the pains more severe in the first stage. There is more delirium, stupor, and subsultus, with but little or no diarrhoea or abdominal tympanitis. Much diagnostic importance has been attached to the character of the eruption, which, in typhus, generally appears on the abdomen and chest between the third and fifth days of the fever, and is papular or petechial in form, much resembling the eruption of measles. It does not entirely disappear under pressure, extends in many cases to the neck, face, and extremities, and in severe cases becomes hæmorrhagic. It differs from the eruption in measles by appearing on the abdomen and chest first instead of the face and neck, and by the absence of the catarrhal symptoms so prominent in measles.

The characteristic eruption appears in typhoid fever in the form of rose-colored lenticular spots, from which the color wholly disappears by pressure and is not distinctly papular in any stage of its progress. The diagnostic value of the

eruptions in these fevers is much lessened from the fact that in many cases of typhus an eruption of dark-red or purplish spots appear in advance of, or interspersed with, the more papular clusters, and in rare cases impart to the surface an erythematous appearance. It is these maculæ that most resemble the eruptions in cases of cerebro-spinal fever. In many cases the eruptions are so intermingled as to leave the most experienced observers in doubt as to the true diagnosis during the whole progress of the disease. [See cases recorded in "Clinical Reports on Continued Fever," by Dr. Austin Flint, 1852; and by Dr. J. M. Da Costa in *American Journal of Medical Sciences*, p. 1, July, 1899.] Again, not a few cases, especially of the milder class, have been met with in which no eruptions of any kind were observed. MM. Louis and Chomel and their followers endeavored to found the diagnosis between typhoid and typhus fevers largely on the abdominal symptoms and pathological changes in the glands of Peyer and the mesentery. The presence of tympanites and gurgling on pressure with liquid stools was regarded as strongly indicative of typhoid; and in fatal cases if the post-mortem revealed tumefaction and ulceration of Peyer's glands in the intestine and enlargement of the spleen and mesenteric glands the diagnosis was regarded as complete. The recently discovered Widal reaction, or serum-agglutination test, was at first thought to be peculiar to the blood-serum of typhoid fever, and therefore valuable in differentiating that disease from typhus and other forms of fever. Further investigations, however, have shown the presence of that reaction in the blood of typhus, yellow fever, and the plague, while it can be obtained in typhoid cases often only after the first



week, and in the most severe cases not at all. It is perhaps valuable as indicating the beginning of immunity, and therefore prognostic in its import.

**Etiology.**—Typhus fever is very generally regarded as a highly contagious affection. But, up to the present time, neither the chemist nor the bacteriologist has been able to identify any specific toxic agent as the essential cause of the disease. Its whole previous history has shown it to be closely connected with populations living in overcrowded, uncleanly, and ill-ventilated houses, camps, prisons, almshouses, and ships, and with insufficient food. Some of the most extensive and destructive epidemics of the disease have followed directly in the wake of famine. This is well illustrated by the history of its prevalence in Ireland and in the countries bordering on the Baltic sea. During the middle part of the present century, when many thousands of immigrants to this country from Ireland and other parts of Europe were crowding almost every sailing vessel that crossed the Atlantic, typhus fever was so prevalent among them that it became generally known as "*ship-fever*," and so filled the quarantine and emigrant hospitals in New York and Boston as to greatly increase the ratio of mortality. But the subsequent rapid and almost complete transference of all immigrant and other passenger traffic from the slow sailing vessels to the fast moving ocean steamships has resulted in nearly banishing the "*ship-typhus*" from the ocean as well as from our important sea-port towns. This change in the ocean travel coincident with extensive improvements in the sanitary condition of most of the great centres of population, both in this country and Europe, has rendered typhus comparatively a rare disease during the last twenty-five years.

**Pathology.**—The assemblage of morbid phenomena constituting typhus fever may be said to consist of diminished sensibility and activity of the nervous structures both voluntary and involuntary, with lessened muscular action; diminished oxygenation of the blood, with imperfect coagulation and impaired condition of red corpuscles; general diminution of secretions, with increase of urea and diminution of phosphates and frequently the presence of albumin in the urine; dark color of blood and tissues, with progressive granular degeneration of the cardiac and muscular structures generally, with enlargement and softening of the spleen, kidneys, and liver, congestion of the mucous membrane of the air-passages, and hypostatic engorgement of lung-tissue. Such an assemblage of phenomena, all in the direction of impairment of both function and structure, implies the presence of some virulent sedative ptomaine, leucomaine, or toxalbumin, or the absence of sufficient oxygen or other agent essential for the maintenance of the vital properties of the cell-protoplasm entering into the composition of the blood and tissues of the body. In the more severe cases these universal changes progress with such rapidity that the heart fails to contract with sufficient force to maintain circulation of the blood, and the patient dies before the end of the first week from general suspension of the phenomena of life. In cases of less severity the same changes take place less rapidly, and fatal exhaustion is not reached until the end of the second week; while cases still milder reach a crisis in about two weeks, when critical evacuations from the skin, kidneys, or bowels occur, and convalescence ensues.

**Prognosis.**—From statistics gathered in the leading hospitals of London, Edin-

burgh, Glasgow, and Paris by Dr. Murchison the average ratio of mortality from typhus was stated to be 18.8 per cent., or a little less than one in five. The ratio varies much in different epidemics. According to Dr. Murchison, the ratio of deaths in the London Fever Hospital in 1850 was 60 per cent., and in Bellevue Hospital, New York, in 1869, it was nearly 20 per cent. In other epidemic seasons it has ranged as low as 8 or 9 per cent. The majority of systematic writers state the mortality-ratio as between 12 and 20 per cent.

In children the death-rate is much lower than in adults, and is greatest in old age. Many recorded facts show that the ratio of mortality in any epidemic of typhus fever is much influenced by the amount of fresh air supplied to the patients. A patient occupying a large, clean, and well-ventilated room or tent, not only has greatly increased chances of recovery, but he very rarely communicates the disease to others who may come in contact with him. This was well illustrated when in 1864 the fever patients were removed from the crowded wards of Bellevue Hospital to tents on Blackwell's Island. In the hospital the death-rate had been from 18 to 20 per cent., and several of the nurses and house physicians had died; but after their removal to the tents with abundance of fresh air and little or no use of alcoholic remedies, the death-rate diminished to between 5 and 6 per cent., and the nurses and medical attendants remained unattacked.

**Prophylaxis.** — The most important measures for preventing the development and spread of typhus are the maintenance of free ventilation, strict cleanliness, wholesome food, pure water, prevention of aggregating of many patients in one room or ward, and the exclusion

of all but the necessary physicians and nurses.

**Treatment.** — In the absence of all knowledge concerning the specific germ or other toxic agent on which the development of typhus fever depends, our treatment must be founded on the indications presented by a careful study of the clinical phenomena of each case, and the known tendency to general granular or cell-degeneration in the various structures of the body. The first and most imperative indication is to secure for the patient an abundance of good fresh air and the enforcement of strict cleanliness of person, clothing, and room, and a judicious supply of pure water and liquid nourishment. The second indication is to repress the rapidly rising temperature of the first stage by frequent sponging or bathing of the surface with cool water, and to promote the natural secretions and eliminations from the skin, kidneys, and abdominal viscera generally, and thereby prevent the accumulation of waste and toxic products in the blood and tissues of the body. The third, is to sustain the cardiac, respiratory, and vasomotor nerve-functions, and to preserve the integrity of the corpuscular elements of the blood and tissue through the second week and until convalescence is fully established. In fulfilling the first of these indications, in addition to the constant supply of fresh air and the maintenance of strict cleanliness, including the prompt removal from the room of all evacuations, careful attention should be given to the ingesta—food and drink. The best and only drink proper should be good, cool water given in small quantity at once, but repeated often enough to help in keeping the mouth moist and in encouraging the natural excretions, without overloading the stomach. For nourishment, good fresh



milk containing 1 ounce of fresh lime-water to 6 ounces of the milk, given in doses of 1 or 2 ounces every two or three hours until the fever reaches its climax from the third to the fifth day, after which it may be moderately increased and often supplemented by 2 or 3 ounces of beef- or mutton- broth salted as much as a well person would relish, given between the doses of the milk. If diarrhoea supervenes during the middle or later stage of the disease, a properly prepared thin wheat-flour and milk-gruel or porridge may take the place of the milk and lime-water with advantage.

In fulfilling the second indication, in addition to judicious and efficient bathing, packing, or sponging with cool water sufficient to moderate the high fever, heat, and promote natural metabolism and excretion, these effects may be further promoted by giving 1 or 2 grains of calomel every two hours until the bowels are moved by it, which will generally be within the first twenty-four hours, and during the same time a mixture of equal parts of liquor ammon. acetatis and spt. of nitrous ether may be given between the doses of the calomel. This may be continued after the operation of the calomel with the addition to each dose of 2 or 3 minims of the tincture of aconite-root so long as the skin remains hot and dry and the pulse firm under pressure. If the small doses of calomel fail to move the bowels within the first twenty-four hours they may be aided by a full rectal enema of warm water holding in solution 2 drachms of chloride of sodium (common salt), which will generally be followed by free evacuations of both fæces and urine.

If the patient passes beyond the first week without excessive delirium or profound stupor, with a temperature not above 104° F. and a pulse not above 120

per minute, little else is required besides a faithful continuance of the hygienic measures already indicated, with the aid of mild diaphoretics and an occasional enema of warm water and salt when needed, and the patient will pass the crisis near the end of the second week in safety. But if at any time after the first five days of the attack the pulse becomes softer and more frequent, with less force and steadiness of cardiac systole, less depth of inspiration with less resonance over the lower and posterior parts of the lungs, and increasing stupor or muttering delirium, the aconite and diaphoretic mixtures should give place to efficient doses of strychnine in solution with nitric or nitromuriatic acid every four hours, and half-way between 10 grains of hyposulphite of sodium and 5 minims of tincture of belladonna in solution in mint-water. There is, probably, no other remedy known to the profession that is more reliable for maintaining the sensibility and action of the respiratory, cardiac, and vasomotor nerve-centres and ganglia than strychnine given in solution with a mineral acid, especially in the advanced stages of typhus and typhoid fevers. And I know of no more efficient antiseptic or antidote for the toxæmic agents pervading the blood and tissues of such patients than efficient doses of the hyposulphite of sodium.

If, as occasionally happens, the bowels become too loose, the hyposulphite should immediately give place to an emulsion of oil of turpentine and oil of wintergreen, to each dose of which from 5 to 10 minims of tincture of opium may be added. On the other hand, cases are sometimes met with presenting an anxious expression of countenance, very frequent pulse, and continued insomnia or sleeplessness, in which a powder com-

posed of Dover's powder, 10 grains; pulverized gum camphor, 2 grains; and calomel, 1  $\frac{1}{2}$  grains, given in the evening, will produce several hours of natural sleep followed by decided improvement in the condition of the patient. When the stage of convalescence is reached, no other treatment is required except to insist on the continuance of rest, good air, and easily digestible food, until a fair degree of nutrition and strength has been regained.

But little has appeared concerning the treatment of typhus fever in the current medical literature of the last two or three years. Legrain [see *Gaz. des Hôpitaux*, July 4, '95] reports having treated a few cases with the serum from convalescent patients, in the form of injections, but without decisive results.

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## U

**URÆMIA.**—Uræmia is the term which is applied to a group of nervous symptoms supposed to be produced by the retention in the blood of excrementitious substances normally excreted by the kidneys, or when there is interference with the secretion or the discharge of the urine. It is met with in Bright's and other disease of the kidneys (cancer, tubercle, suppuration, etc.), and in cases of anuria, obstructive or non-obstructive, in pregnancy and in parturition.

**Symptoms.**—All the nervous functions may be involved in uræmia. The principal cerebral and mental derangements are drowsiness, stupor, coma, and delirium. The most common disorders of the sensory functions are pain, especially in the head, sometimes very persistent and intense; dimness of sight, or actual blindness of one or both eyes, sometimes attended by albuminuric retinitis or in some cases without retinal lesion; tinnitus aurium, and sometimes deafness. Among the disorders of the motor functions, the most important are involuntary muscular twitchings or general convulsions; the tendency to vomiting; and not infrequently extreme dyspnœa. By close observation we distinguish two forms of uræmia: the *acute* and the *chronic*.

**ACUTE URÆMIA** includes all the varieties in which the symptoms develop suddenly. Acute uræmia occurs not only with the different forms of nephritis, but also with angina pectoris, pulmonary emphysema, and chronic endarteritis. Three forms are commonly recognized: the comatose, the convulsive, and the mixed; less frequently met with are the delirious, dyspnœic, ocular, and articular.

In the acute comatose form coma rapidly develops, after the appearance of headache, giddiness, more or less disturbance of vision, vomiting, or delirious excitement; or it may be unattended by premonitory symptoms. The face is usually pale; the pupils react slowly to light and are dilated or unaltered; in other cases we may observe a red spot on the cheek, injected conjunctivæ, and contracted pupils. There is a peculiar, stertorous breathing—not the deep snoring observed in hæmorrhagic apoplexy, but a sharper, more hissing sound, produced by the rush of expired air on the hard palate or teeth (T. Grainger Stewart). Death may occur in a few hours from a rapid deepening of the coma; or the patient may recover and continue permanently free from the symptoms; or uræmia may recur, sooner or later, in



one of its many forms and death follow. Acute uræmic coma may occur in any of the various forms of Bright's disease, but is most frequent in the cirrhotic and inflammatory varieties.

The *acute convulsive* form may be marked by symptoms almost exactly simulating those of epilepsy; or may not be attended by loss of consciousness; or may be confined to certain groups of muscles, and thus simulate tetanus. The attack is sudden, with or without warning. It may be a single attack, or a rapid succession of attacks may occur: five or six, or even more, in the course of twelve hours. These attacks may prove rapidly fatal, either during the paroxysm, or in the coma which succeeds it; or they may be recovered from. Convulsive attacks may occur in any of the various forms of Bright's disease, but most frequently in the cirrhotic and inflammatory varieties; they may, indeed, be the first warning of the existence of cirrhosis of the kidney.

Case of a woman who had several attacks of convulsions followed by coma, with conjugate deviation of both eyes to the left, with unilateral twitchings, while the right side seemed paralyzed. At the autopsy the kidneys were found to be nephritic, the brain slightly œdematous and congested, but no gross lesions were found. F. Krauss (Phila. Med. Jour., Apr. 14, 1900).

Air-hunger, first described by Kussmaul, was for a long time considered characteristic of intoxication by oxybutyric acid, as it occurs only in diabetic coma. Later investigations, however, showed that a similar symptom-complex may occur in a number of other conditions, such as severe anæmia, carcinoma, cachexia, gastro-enteric disturbances, and salicylic acid poisoning. The possibility of the dyspnœa being uræmic had already occurred to Kussmaul, but the absence of headache, slowing of the pulse, diminished diuresis, and catarrh of the finer bronchi in diabetic coma led him to consider it something different. F.

Dineles (Wiener klin. Rund., April 20, 1902) has observed a case of pure uræmia in which acetone and diacetic acid could be detected in the urine and in which a distinct diabetic air-hunger was present, while in several similar ones no excretion of acetone or allied bodies occurred. No disturbances of heart or respiration were present to explain the symptom; probably an irritation of the respiratory centre existed. The character of the renal change played no part, since in his patients the various, different lesions of chronic nephritis were found; a point of importance, however, was the fact that epileptic attacks did not occur. (Medical News, July 19, 1902.)

The other forms mentioned (mixed, delirious, dyspnœic, etc.) need no detailed description.

CHRONIC URÆMIA usually develops gradually, and may not be recognized at once, although the pathognomonic listlessness and indifference of manner in cases of Bright's disease becomes somewhat more marked. The movements become slower, and speech is somewhat indistinct. Dimness of vision, tinnitus aurium, and uneasy feeling in the head or, mayhaps, violent and persistent headache may be present. The symptoms occasionally improve or disappear, but they uniformly recur, and gradually become more intense. The drowsiness passes into stupor. When the patient is roused to speak, articulation is at first thick and indistinct, and, later, the patient cannot be made to respond; stupor deepens into coma; the breathing assumes that characteristic stertor before mentioned; and death ensues. Exceptionally, the patients may suffer from a noisy delirium, in which prolonged howling alternates with muttering or with paroxysms of excitement; there may be low prolonged muttering, with a repetition of the same word or phrase. Subsultus tendinum and twitching of the facial muscles are com-

monly seen throughout. Convulsions, diarrhœa, and vomiting are frequently present. Epistaxis may occur, but is rare.

In chronic uræmia, says Delafield, the convulsions, sudden coma, dyspnœa, high temperature, aphasia, hemiplegia, and contractions of the arteries are absent. The action of the heart and pulse are feeble. The patients pass into a condition of great prostration, with alternating delirium and stupor. The fatal termination in cases of chronic Bright's disease is commonly by this form of uræmia. It may occur, as an exception, in the early stage of the inflammatory form.

**Diagnosis.**—Acute comatose uræmia may closely resemble cerebral apoplexy with loss of consciousness, but may be distinguished from it by the absence of unilateral paralysis, the character of the breathing, pulse, and heart-action, and the condition of the urine.

Acute convulsive uræmia may resemble epilepsy, but it usually lacks the initial cry, the death-like pallor, the predominance of unilateral convulsions, the inturning of the thumbs upon the palms, and the loss of reflex irritability. The urine, after an epileptic seizure, may reveal the presence of albumin and a diminution of urea, but it soon returns to a normal condition; in uræmia it is always distinctly albuminous. The condition of the pupils and the examination of the urine will distinguish this condition from poisoning by opium or belladonna.

Chronic uræmia, when fairly established, is usually recognized without difficulty. An examination of the urine furnishes the most valuable evidence. Chronic uræmia may sometimes resemble fever or meningitis, from which it may be differentiated by the history of the illness, the condition of the urine, the temperature, breathing, and weak pulse and heart-action. Pepper calls our attention

to certain cases which develop gradually and pass into a typical typhoid state which cases are met most frequently at or after middle life and in connection with chronic interstitial nephritis. The facial expression and mental state are curiously like those of typhoid fever; a low grade of fever with bronchial and gastro-intestinal catarrh is not unusual. The detection of arteriosclerosis and cardiac hypertrophy and albuminuria with casts; the odor of the breath; the absence of eruption, epistaxis, and splenic enlargement; and the history and course of the case will serve to establish a diagnosis.

**Etiology.**—The etiology of uræmia is not definitely known. Francis Delafield says that contraction of the arteries (a condition existing in acute uræmia) causes the involuntary contraction of groups of muscles, general convulsions, stupor, coma, dyspnœa, labored heart-action, hypertrophy of the left ventricle of the heart, blindness, aphasia, hemiplegia, a high temperature, and, perhaps, dropsy. Acute uræmia is often developed in nephritis while the specific gravity of the urine is still good, and the quantity of the urine is not diminished until after the contraction of the arteries is established. There can be no reason, therefore, to believe, says Delafield, that the contraction of the arteries is due to contamination of the blood by excrementitious substances, and we must frankly admit that the reason of the contraction is yet unknown. We know, however, from a wide experience, he adds, that when by the use of drugs we can dilate the arteries, the symptoms dependent upon their contraction will disappear. Chronic uræmia is developed in persons who are passing little or no urine, or urine of low specific gravity, and is evidently caused by the contamination of the blood by excrementitious substances.



Personal inclination is to the view that the conception of the term uræmia should be extended to include every case of renal insufficiency for urea, although well-defined uræmic symptoms be wanting. Typical uræmic symptoms may arise in persons whose blood shows no increase in urea, but this fact does not deprive the accumulation of urea, salts, etc., of clinical significance; it merely illustrates that the pathological basis of what is clinically termed uræmia is not always the same. It seems desirable that any toxæmia should be regarded as uræmic which can be shown to depend on the incapacity of the kidney to perform the functions of a healthy kidney, whether these functions consist simply in the elimination of substances as they exist in the blood furnished by the renal artery, or whether they shall be shown also to consist in the transformation of certain elements of the blood previous to elimination. C. A. Herter (Montreal Med. Jour., May, '98).

Experiments regarding the relation of an excess of urea in the blood seem to show that a large excess of urea in the blood is capable of giving rise to disturbances which manifest themselves clinically, although in some examples of conditions included by clinicians as uræmic it is quite clear that urea can play no part in occasioning the symptoms. C. A. Herter (W. H. Welch Festschrift; Phila. Med. Jour., June 2, 1900).

Ordinary urine contains an organic liquid substance about twice as abundant in volume as urea, personally named "ureine." It resembles olive-oil, is slightly bitter, and seems fatty; the specific gravity is 1.270, and it mixes freely with water and alcohol. It probably belongs to the alcohols of the aromatic series, is easily disintegrated at a temperature of 80° C., and has a remarkable power of absorbing oxygen. Ammoniacal fermentation of the urine cannot proceed in its absence except in the presence of considerable heat. Its potential energy is about 130° C., but this varies considerably in different specimens. W. O. Moor (Med. Record, Sept. 1, 1900).

**Prognosis.** — The occurrence of uræ-

mia is always grave. The acute forms are often recovered from, or subside spontaneously. When they are due to chronic renal disease, recovery is, as a rule, out of the question; they may be looked upon as the messenger of death. When they are due to acute disease, the prognosis is more hopeful, as the conditions leading up to them are often amenable to treatment. Puerperal cases are very frequently recovered from, as the combination of circumstances upon which they owe their origin is of short duration.

The chronic form of uræmia is utterly hopeless, and, when it appears, the patients' days are numbered.

**Treatment.**—The first indication is to restore the secretory functions of the kidneys. To this end we may apply cups, leeches, or poultices over the loins and administer bland diuretics. It is often found that the action of diuretics is delayed until the bowels have been well emptied by means of jalap, elaterium, or calomel purges. The use of the hot pack or of diaphoretics will hasten and assist the action of a diuretic. Venesection has its advocates, especially in puerperal and acute inflammatory cases.

Experiments undertaken for the purpose of finding some explanation of the beneficial effects claimed for venesection in uræmia. While in uræmia there is usually an increase in molecular concentration, the experiments in no case showed that venesection, with or without saline infusion, produced any diminution of this concentration or osmotic pressure. Some other explanation must, therefore, be found. P. F. Richter (Berliner klin. Woch., Feb. 12, 1900).

In the selection of drugs for the treatment of uræmia, the following clear and scientific directions are given by Francis Delafield, of New York: "As disturbance of the circulation, with dyspnoea, vomiting, or cerebral symptoms are liable to come on at any time, we constantly watch

the heart and arteries. If the arteries become contracted and the pulse tense, we at once give iodide of potash, nitroglycerin, chloral-hydrate, or opium. If the heart's action becomes feeble, we use digitalis, caffeine, or strophanthus. As regards the use of opium, it is apparently safe and beneficial to use it if the arteries are contracted; if they are not, even a little opium may cause poisoning and death. So with general convulsions or sudden coma—an hypodermic injection of from  $\frac{1}{8}$  to  $\frac{1}{4}$  grain of morphine may be of decided benefit; and in protracted contraction of the arteries, with sleeplessness and restlessness,  $\frac{1}{8}$  grain of morphine every three hours may give great relief."

Tonic remedies and milk diet (nourishing, diuretic, and supplying little excrementitious matter) may be given to prevent, if possible, a return of the symptoms. In puerperal cases delivery should be completed with as little delay as possible.

Treatment of uræmia consists in lavage of the stomach, the intestine, and the blood. The object is to diminish the sources of intoxication. Possibly the patient has hyperchlorhydria; then the stomach sometimes contains very powerful toxins. In such a case, with contraction of the extremities, a toxin has been isolated capable of killing a rabbit in a few minutes.

In lavage of the intestine, ordinary enemata are not sufficient. Twice or thrice a day one should introduce, by a long, soft tube,  $3\frac{1}{2}$  pints of boiled water containing 7 per cent. of table-salt.

In lavage of the blood, it is not necessary to introduce saline solution directly into the veins. The introduction subcutaneously of 7 to 10 or even 17 ounces, twice or thrice a day, acts almost as well. Three and a half pints have been injected at a time. In a month, one patient received 29 pints subcutaneously and 24 by the rectum.

The "three lavages" have given excel-

lent results in the treatment of uræmia. This treatment is preferred to emetics and purgatives. Purgatives, emetics, and bleedings should not be altogether renounced, however. Sometimes blood-letting, in considerable quantity, should precede the subcutaneous injection. H. Huchard (*Jour. des Pract.*, Feb. 4, '99).

In cases of uræmia, both acute and chronic, in which an exclusively milk diet is badly borne, pure water, together with an exclusively vegetable diet, is of value. Under this treatment it has been found in these cases that every trace of albumin disappeared from the urine, and generally the proportion of albumin under such dieting was less than under a milk diet pure and simple. The treatment should be temporary, only lasting a few days. Renon (*Revue Thér.*, July 1, '99).

As it seemed certain that the blood of the renal veins would contain the essential principles of the internal secretion of the kidney, it was suggested that injection of such blood might yield still better results. A special experimental study of the question was made in the Lyons Hospital. The blood of the renal veins of a young and healthy goat was drawn aseptically, its serum was allowed to separate, and then it was put up in 20-cubic-centimetre bottles. This serum gave rise to no unpleasant effects when injected subcutaneously, and was used in three cases of uræmia with good results. Improvement generally showed itself within three hours of an injection. The violent headache first disappeared, while the nervous troubles, prostration, etc., were sometimes replaced by almost exuberant gaiety. Vomiting ceased after a single injection, and the oppression and dyspnoea ceased after a short time, the urine becoming abundant as the œdema disappeared. Lignerolles (*Treatment*, Oct. 12, '99).

After using ether in the treatment of uræmia during several years, conclusion that it is especially valuable in cases of uræmic dyspnoea, the ether acting as a stimulant to the nervous system and as a diuretic. It is administered every hour, or even every half-hour, if need be, in  $\frac{1}{2}$ -drachm doses, sub-



cutaneously, with 1 drachm by the mouth alternately. The procedure is painful and is best restricted to patients in coma. It must be introduced deeply under the skin and cellular tissue to avoid sloughing. If injections cannot be used, a drachm or more may be given with syrup and water every half-hour. Rapid improvement follows. The number of injections or internal administrations should be reduced as soon as the dyspnœa subsides, and discontinued entirely only when diuresis is thoroughly established. The method is only effective, of course, in kidneys that are partly fulfilling their functions, and good effects are observed chiefly in cases of chronic interstitial nephritis. Lemoine (Zeits. f. Rationelle Prakt. Aerzte, Apr., 1900).

The use of saline solution subcutaneously, intravenously, or per rectum sometimes saves cases in which all other measures have failed.

## URINARY SYSTEM, DISEASES OF.

**Diseases of the Kidneys** (see also BRIGHT'S DISEASE, volume i).

**Pyelitis (Pyelonephritis; Pyonephrosis).**

**Definition.**—Inflammation of the pelvis of the kidney. Concomitant inflammation of the renal substance justifies the term *pyelonephritis*; and intense and extensive purulent involvement, the term *pyonephrosis*.

**Symptoms.**—These are frequently overshadowed by those of the primary condition that causes the pyelitis; they are varied, also, for the same reason. The simple catarrhal pyelitis may cause slight pain and tenderness in the region of the affected kidney or kidneys, mild fever, with a turbid urine of acid reaction, showing a few pus-cells, a little mucus, rarely some red corpuscles, and a trace of albumin, perhaps.

In the severer varieties, as in calculous pyelitis, the occasional concomitant attacks of renal colic are attended with the

presence of blood and pus in the urine, with some mucus, and the transitional caudate epithelial cells from the middle layers of the mucosa of the renal pelvis. The presence of the latter, however, is not constant; hence their absence does not exclude the existence of a pyelitis, since some of the most destructive forms of the affection, as the acute or chronic suppurative or the pyelonephritic may be unaccompanied by the presence of the pelvic epithelium in the urine. This holds true still more in the case of pyonephrosis, in which the kidney often becomes one large abscess.

In severe pyelitis the pain is very acute, coursing down the ureters. The fever is moderate; and most of the symptoms common to nephrolithiasis are manifested.

The symptom of a well-marked pyelitis is a pain in the loins, with extension to the abdomen, to the groin, to the thigh, and to the testicles. There is also tenderness; urination is frequent, and very often painful. The urine is found to contain albumin, mucous casts, epithelium, in the marked cases pus. W. M. Ord (Practitioner, Sept., '97).

In *pyonephrosis* and *pyelonephritis* the fever is rather hectic or typhoid in type. Paroxysms of rigors or chills, followed by a rapid rise of temperature to 104° or 105°, and ending in profuse and exhausting sweat, may be observed; or there may be marked prostration, dryness of tongue and skin, feebleness of pulse, stupor, and delirium. Pyæmic cases reveal a temperature-curve of irregular course, with marked remissions.

In obstructive pyelitis the urine sometimes flows freely and normally for awhile, until the increasing pain over the affected kidney ends in relief by the expulsion of the obstacle and the passage of purulent urine. This alternation of normal with purulent urine is indicative of a unilateral pyelitis.

The urine is ammoniacal in cysto-pyelitis. Albuminuria is shown according to the degree of pyuria, and associated nephritis.

In chronic suppurative pyelitis or pyelonephritis the pyuria is variable, both in quantity and constancy. Intermittent pyuria may be due to the temporary blocking of the ureter by a stone (obstructive pyelitis). The pus is seldom mixed with epithelium in chronic purulent pyelitis. The associated intermittent fever may be like that of tuberculous pyelitis, and marked prostration, anæmia, and emaciation are concomitants. Evidences of amyloid change may be revealed in long-standing chronic cases.

The term *ammoniæmia* has been applied to that complexus of nervous symptoms that is supposed to arise from the decomposition and absorption of urinary substances. These symptoms may be similar to the manifestations of diabetic coma.

Distinct enlargement and fluctuation in the lumbar region may be determined in many cases of pyonephrosis. This may also be intermittent, being detectable while there is obstruction to the flow of pus, and *vice versâ*. According to A. H. Smith, at the menstrual periods pyelitis may be subject to marked exacerbations, simulating renal colic.

In chronic pyelitis with progressive atrophy of the kidney, uræmia is likely to terminate the case.

**Diagnosis.** — Besides excluding other affections that might be confounded with pyelitis, it is important to attend to the history of the case with a view to the discovery of the cause; the urinary findings must also be studied carefully. The very nature of this affection makes it often most difficult to exclude other affections of the urinary tract, as nephritis, cystitis, and urethritis. Any severe in-

flammation of the tract in which the lower portion is known to be affected is generally associated with pyelitis or pyelonephritis, from the well-known tendency to extension by continuity.

Epithelium from the pelvis of the kidney cannot well be distinguished from transitional bladder-cells; but, given the indications of a pyelitis, its calculous cause is at once made clear upon the passage of the characteristic uratic or oxalatic concretions. It may happen that the urine from one kidney is prevented from flowing by the impaction of a stone in the ureter. The urine may now flow clear from the other and vicariously acting kidney until, the stone having given way, it suddenly increases in quantity and changes in character, owing to the return of the morphological elements of the pyelitis (corpuscles, desquamated epithelium, crystals, and *débris*).

Catheterization of the ureters and renal pelves, particularly in women, as described and practiced by Pawlik and Kelly, is a certain method of determining from which side the purulent urine flows. Palpation of the ureters through the vagina will sometimes reveal thickening and tenderness in cysto-pyelitis, and ureteral distension may sometimes be felt in pyelitis calculosa.

Vierordt mentions having seen in some cases of pyelonephritis, peculiar hyaline casts "split like a pair of trousers." Casts and albumin are usually present when the kidney-structure is involved by extension of the pyelitis, while marked pain in the region of the kidney indicates predominant pyelitis, though it does not exclude the possibility of co-existing nephritis. Marked vesical irritability points to associated cystitis; but in intense pyelitis with much pus and an acid urine, vesical tenesmus may also be troublesome. Tuberculous can be discriminated from cal-



culous pyelitis, possibly, only by a consideration of the history and general condition, and by the detection of tubercle bacilli in the pus. The presence of a fluctuating tumor in the lumbar region is significant enough of pus, but it is very difficult to determine whether it is due to pyonephrosis or perinephric abscess; the history, pyuria, and less œdematous overlying tissues of the former are important distinguishing points.

The *hæmorrhagic pyelitis* of Senator, Delafield, and others, described as occurring in milder forms, and particularly in girls of neurotic types, may be revealed by the intermittent hæmaturia and occasional lumbar pain, lasting but a few days or a week, and followed uniformly by recovery. Digestive disturbances may be prominent in these cases.

Much difficulty is sometimes experienced in diagnosing pyelitis when co-existent with cystitis. It should be recollected that their histories differ, pain in the lumbar region being present in the former and in the bladder in the latter; acid pus is usually characteristic of pyelitis.

The following differential points based upon the study of a number of cases, suggested: (1) an alkaline reaction is not found in uncomplicated pyelitis; (2) the maximum of albumin in the urine of cystitis is about 0.15 per cent., while in pyelitis there is not less than two or three times as much albumin; (3) if nearly all the pus-corpuscles are crenated, pyelitis is probably present; (4) also, if the red corpuscles show chemical and morphological decomposition, if the hæmaturia is microscopical only, and if there is no vesical tenesmus; (5) unless non-imbricated, small epithelial cells should be present, which would favor the diagnosis of some cystitis. Rosenfeld (Berl. klin. Woch., July 25, '98).

*Surgical kidney*, so called, which is an acute suppurative nephritis, is the result of an acute bilateral pyelitis due to the

extension upward of a severe cystitis. Acute suppuration or interstitial inflammation of the kidney due to metastatic or miliary abscesses, occurs as a complication of pyæmia.

**Etiology.**—The causes of pyelitis are practically of secondary origin. They are mainly as follows: (1) renal calculi [the most frequent]; (2) urethritis, cystitis, or ureteritis extending upward; (3) retention of decomposed urine in the pelvis of the kidney; (4) renal affections, or tubercle, carcinoma, and acute nephritis; (5) specific fevers, including influenza, perhaps; (6) other foreign bodies than stone; (7) irritating diuretics. Regarding the cause first mentioned, it should be pointed out that calculous pyelitis may result from the irritation of the constant presence and passage of small stones ("gravel"), or even of uric-acid "sand," as well as from the large dendritic concretions that send offshoots into the calyces. Extensions of inflammation to the pelvis from lower portions of the urinary tract may occur in protracted cases of such affections as gonorrhœal urethritis and puerperal and calculous cystitis. Obstructive pyelitis sometimes follows the impaction of renal calculi or of other foreign bodies in the ureter when there is pre-existing inflammation of the tract or when, as usually happens, there is chemical irritation from the decomposition of the accumulated urine. There may be obstruction in the bladder and urethra, as from enlarged prostate, stricture, or phimosis.

*Infectious pyelitis* may result from small-pox; diphtheria; typhus, scarlet, and typhoid fevers; and is probably produced by the toxic substances eliminated. Nephritis is commonly associated with it (pyelonephritis). Parasites—such as the echinococcus, distoma, strongylus, and filaria—may give rise to pyelitis.

Cantharides, cubebs, copaiba, turpentine, etc., and diabetic urine even may in rare instances excite this affection.

**Pathology.** — The morbid changes in the simple, catarrhal variety of pyelitis consist of a congested, swelled, and sometimes ecchymotic, mucous membrane covered with a viscid, smooth exudation of muco-pus and desquamated epithelium. The urine in the pelvis of the kidney is turbid from the admixture of pus-corpuscles and epithelium. In calculous pyelitis, owing to prolonged and severe irritation, purulent inflammation and ulceration prevail, and the renal structure is also involved by extension (*pyelonephritis*). Renal abscesses are thus formed, and small dark calculi are found frequently, mingled with the pus in numerous small abscess-cavities; or, perhaps, the destroyed renal parenchyma may be entirely replaced by one large abscess (*pyonephrosis*).

Case of pyonephrosis in which renal substance was found almost entirely destroyed and replaced by large intercommunicating cysts containing thin, turbid, fluid urine and some pus, besides eight to fifteen calculi. Loomis (Med. Record, Feb. 23, '95).

A diphtheritic inflammation, with the formation of a false membrane and sloughing of the pelvis, sometimes follows the severe infection of the specific fevers. Marked hæmorrhagic areas may also be seen. In tuberculous pyelitis there is usually associated a nephritis with areas of tuberculous softening and ulceration, and later pyonephrosis. In certain chronic cases of pyelitis there may be cheesy masses of infiltration affecting the kidney-structure; calcification of these may ensue.

Persistent obstruction leading to pyelitis is associated with dilatation of the pelvis from retention of urine or pus (*pyonephrosis*). This, in turn, from pro-

longed pressure, causes the marked atrophy of the secreting structure of the kidney that is seen in such cases. There is also an increase in the interstitial tissue with secondary contraction.

**Prognosis.** — Renal complications always make the pyelitis a serious affection. Catarrhal cases recover. Calculous pyelitis tends toward chronicity. Pyelonephritis and pyonephrosis are likely to end fatally from exhaustion or uræmia. Perforation and the discharge of pus into the peritoneal cavity, pleural sac, intestine, and bronchi, even, may precede death. The gravity of all cases of pyelitis depends upon the causes and upon the tendency to consecutive suppuration.

**Treatment.**—This varies according to the cause: the latter needs to be removed, its effects counteracted, and its return avoided. The treatment of calculous pyelitis is essentially that of nephrolithiasis. Primary inflammation of the lower portion of the urinary tract must be combated, causes of urinary retention and decomposition must be diminished, infectious fevers must be judiciously handled, and irritating diuretics withheld.

In all forms of pyelitis local measures are useful, in the form of hot-water bags, fomentations, dry cupping, etc. Internally, the use of diluents is to be encouraged, especially the alkaline mineral waters, flaxseed- and moss- teas, barley-water lemonade, skimmed and butter-milk.

Among drugs selected for their soothing properties are the potassium citrate, uva ursi, buchu, and pareira brava. In the event of suppuration surgical intervention is necessary. Irrigation by means of Kelly's ureteral catheter may be practiced with good results in females suffering from purulent pyelitis. Operation through the back is usually indicated in



pyelonephritis and pyonephrosis. In chronic pyelitis such stimulating and alterative drugs as salol, and the oils of turpentine, sandal-wood, juniper, copaiba, and erigeron, may be tried.

Bovet and Huchard recommend the treatment of infectious pyelonephritis by the hypodermoclysis of chloride-of-sodium solution.

The first element of importance in pyelitis is diet. In the acute form the patient should be kept in bed till the urine be normal and micturition easy, with milk diet and lukewarm baths; every second day a good rubbing. In the summer months his residence should be at the sea-coast, with lukewarm sea-water baths. In chronic cases the wells of Vichy, Carlsbad, and the different carbonic springs, as Bilner Sauerbrunn, Prelauwasser, Krondorfer, Sauerling, etc., may be found beneficial. In place of those mineral waters, aqua calcis, 6½ to 19 ounces several times a day, may be substituted. In the early stages of acute pyelitis, tannin, alum, and acetate of lead are often found useful; in chronic cases small doses of extract of *secale cornutum* have been administered with advantage. Monti (*Inter. klin. Rund.*, March, '93).

Case in which the urine was markedly foetid; much pain was experienced during urination and in the interval. Six-grain (0.40 gramme) doses of urotropin relieved the pain and cleared up the urine. The odor disappeared and the pus also, and in a few weeks the patient was free from severe paroxysmal attacks of cystic colic. In another case a chronic cystitis was accompanied by an ulceration at the base of the neck of the bladder. Notwithstanding free curetting of the ulcerated area, improvement did not follow until after the administration of urotropin. J. P. Simpson (*Therapist*, vol. vii, p. 81, 1901).

### Amyloid, Lardaceous, or Waxy Kidney.

It is an open question whether this condition should be considered separately, since it is but a local manifestation

of a wide-spread process due to various causes: syphilis, tuberculosis, etc. It also appears as the manifestation of the degenerative process of advanced Bright's disease, especially in the form following low fevers. It has already been alluded to in the article on BRIGHT'S DISEASE (volume i).

**Symptoms.**—The condition itself may not present distinct clinical features. There is usually found a history of long-continued suppuration, or of syphilis; perhaps of alcohol. The urine gives generally very fairly characteristic indications. Its quantity is increased, its specific gravity is somewhat, but not greatly, diminished, varying from 1015 down to 1005. It is usually singularly clear and translucent, and on standing yields very little sediment. Under the microscope may be found a few casts which are generally hyaline. Albumin is present in large quantity. In later stages, when degeneration has set in, the urine becomes reduced in quantity, is mostly turbid, and then presents under the microscope the morphological signs belonging to the degenerative process. There are associated with this condition of urine anæmia, debility, but not often much dropsy, with the characteristic transparent and delicate complexion. There is usually degeneration of blood; often diarrhoea and vomiting. Cerebral symptoms are not at all common. The arteries are usually soft, and the heart generally shows very little change. Death comes by wasting, diarrhoea, inflammation, and the kindred affections of the liver and other organs. (W. M. Ord.)

**Diagnosis.**—The diagnosis cannot usually be made from the urinary examinations alone. But if following syphilis, tuberculosis, or chronic bone-suppurative, the urine is found to be albuminous, of low specific gravity, and increased in

quantity, and the liver and spleen are enlarged, the diagnosis of amyloid disease may be made with comparative certainty.

**Etiology.**—Amyloid kidney is usually associated with amyloid degeneration in other organs, as the liver and spleen, and is the result of wasting diseases, tuberculosis of the lungs or intestines, syphilis especially tertiary, chronic bone-suppurative, or other prolonged suppurative processes. It may sometimes be a sequel of gout or chronic valvular insufficiency.

Experiments with turpentine in the case of three dogs, by which waxy changes were produced in all, the spleen being most extensively affected. Czerny (Centralb. f. allg. Path., Apr. 15, '96).

**Pathology.**—Macroscopical examination shows the kidney to be firm, large, smooth, and pale, except where the stellate veins are prominent. The capsule is easily detached. Upon section the cortex is seen to be wider than normal and pale, while the pyramids are deep red. The Malpighian tufts, which are the parts most affected by the waxy change, are translucent. Accompanying this degeneration is a diffuse nephritis,—with fatty degeneration affecting the epithelium of the tubes especially,—glomerulitis, and thickening of Bowman's capsules.

**Prognosis.**—This depends, to a great extent, upon the disease which is the cause of the amyloid condition, but is usually very grave.

**Treatment.**—The original disease is to be treated according to indications, while the kidney trouble will be best met by the remedies and general dietetic and hygienic measures used in chronic Bright's disease (*q. v.*, volume i).

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## URINARY SYSTEM, DISEASES OF (SURGICAL).

### Diseases of the Kidneys (CONTINUED). Movable and Floating Kidney.

The term *movable* kidney is used to designate those cases of displaced and not fixed kidney in which the movements are entirely subperitoneal. In *floating* kidney the movements are intra-abdominal; the organ is surrounded by peritoneum and has more or less of a mesonephron. The former variety is usually acquired, while the latter is said to be only congenital. This, however, is quite doubtful.

**Symptoms.**—The subjective signs of movable kidney range from slight discomfort to intense pain, depending, to some extent, on the amount of mobility. Most commonly the pain is dull, aching, or dragging, located in the loin and aggravated by exertion, constipation, and often by menstruation. Occasionally it is paroxysmal, not unlike renal colic. Kinking or torsion of the ureter may cause transitory attacks of hydronephrosis. Gastric symptoms and disorders of digestion have also been frequently observed.

[Edebohls (Centralb. f. Gyn., xxii Jahrg., No. 40) reports fifty-eight cases in which he believes appendicitis was caused by the venous stasis in the region of the cæcum resulting from the pressure of floating kidney. This view seems confirmed by the relief of symptoms in twelve cases by nephropexy. W. W. KEEN and M. B. TINKER.]

The chief symptoms of movable kidney are pains in the back, generally of a changing character, from dull to sharp. Dizziness is also a frequent symptom. Then come those symptoms due to enteroptosis and the gastric symptoms. Those of the circulatory system, consisting of palpitation, sometimes irregular heart-action, distension of the abdominal aorta, throbbing of this vessel, kinking of the renal artery, and occasionally a bruit in this place. Then the symptoms



from the nervous system; neurasthenia, trembling, dizziness, occipital or frontal headaches, and deep depression. A great many of the symptoms of the movable kidney are doubtless caused by pressure on the solar plexus. Gustav Fütterer (*Amer. Gynæc. and Obstet. Jour.*, Feb., '99).

The symptoms of movable kidney in children are very variable; often the affection is absolutely latent. Pain, at times paroxysmal, is sometimes present, and may come on after some unusual fatigue or effort. The kidney may become twisted and the ureter occluded, causing hydronephrosis, which may be transitory, intermittent, or persistent. Coprostasis, appendicitis, different cystic or solid tumors of the kidney, perinephritis, and stone are among the conditions to be excluded. Palpation usually reveals the presence of a smooth, rounded, movable mass. Comby (*Amer. Jour. Med. Sci.*, Mar., '99).

On palpation, a tumor of the size, form, and consistency of the kidney can be usually made out; the tumor slips away under the fingers, generally to the region of the loin. The range of mobility may be slight, but in some cases it is so great that the tumor may be felt near or past the median line or in the inguinal region. Manipulation often gives rise to sickening pain, similar to that produced by compression of the testicle or ovary.

The failure of the kidney to ascend after a forced inspiration is a satisfactory test, even if the kidney only comes down low enough to enable its inferior extremity to be felt. Mansell Moullin (*Brit. Med. Jour.*, i, 566, 1900).

The diagnosis from very mobile, distended gall-bladder and tumors of the intestine, especially the large intestine, is sometimes difficult. The kidney is much more deeply located posteriorly, however, and if it is possible to fix the liver it will be impossible to make the gall-bladder disappear as the kidney does.

In the diagnosis of movable kidney one should find a more or less movable

tumor somewhere in the abdomen, which has the size, shape, and consistency of a kidney. An attempt is to be made to feel the hilus, and, if possible, the pulsation of the renal artery. This examination is best made by relaxing the abdominal walls by flexing the thighs and raising the upper portion of the body, standing on the right side of the patient if the right kidney is being examined. The left hand is put in the right lumbar region pressing upward, while the right hand carefully palpates the abdomen and only gradually goes down deeper. If in this way a tumor is found which seems to be the kidney, the patient should be put into the knee-elbow position and one should try to percuss both kidneys in order to ascertain the absence of one of them. Gustav Fütterer (*Amer. Gynæc. and Obstet. Jour.*, Feb., '99).

In the case of intestinal tumors, stenosis of the gut sometimes settles the diagnosis. Tumors of the omentum occupying the right hypochondrium are rare, growths of the pylorus usually cause greater gastric disturbance and are situated higher and nearer the median line, and impacted fæces disappear after a purge.

**Etiology.**—The condition is much more common in women; it is most frequent during the child-bearing period and particularly in women who have borne several children. This is thought to be because of the lax condition of the peritoneum, of the abdominal wall, and the absorption of the circumrenal fat thus induced, for movable kidney may follow emaciation due to any wasting disease. The right kidney is affected four times as often as the left; this is attributed to the proximity of the liver, which, in its movement downward with the diaphragm, may force the kidney before it. Traumatism has been mentioned as a cause, but this is not in accord with the infrequency of the condition among males. Probably in most cases renal mo-

bility is to be attributed to a combination of several causes.

Arab women wear no corset, girdle, nor any form of dress likely to influence displacement of the kidney; yet the proportion in which this organ was found on examination to be freely movable amounted to no less than 42 per cent. of the cases examined. This is a higher percentage than is found in corset-wearing European women. M. Trekaki (*Edinburgh Med. Jour.*, Dec., 1900).

The essential cause of movable kidney lies in a particular body-form. The chief characteristics of this body-form are a marked contraction of the lower end of the middle zone of the body, with a diminution in the capacity of this portion of the body-cavity. This diminution in the capacity of the middle zone depresses the kidney so that the constricted outlet of the zone comes above the centre of the organ, and all acts—such as coughing, straining, lifting, flexions of the body, etc.—which tend to adduct the lower ribs press on the upper pole of the kidney and crowd it still further downward. It is the long continued repetition, in a suitable body-form, of these influences, which collectively may be called internal traumata, that gradually produces a movable kidney. A distinctly movable kidney is never the immediate result of a single injury or external trauma. M. L. Harris (*Jour. Amer. Med. Assoc.*, June 1, 1901).

Analysis of the literature in relation to trauma and movable kidney, as well as a study of 41 cases in which kidneys of more or less mobility were found in individuals who had sustained some traumatism, the author comes to the following conclusions: Movable kidneys occur in women with a particular body form, and practically all women with this body form have movable kidneys of greater or less degree. After carefully analyzing his 41 cases, taking into account the injuries and the manner in which they were produced, together with the results of the examination, the conclusion is inevitable that in not a single case is it at all certain or even probable that the kidney was made

movable by the accident. A kidney already movable may be injured by violence as well as one that is normally fixed, or symptoms connected with a movable kidney may be aggravated by injury. A probable explanation in many of the cases is that a movable kidney which had existed for some time without giving rise to symptoms was recognized after an accident and the symptoms referred to it. While it is possible to injure, crush, or suddenly displace by violence a normally fixed kidney, such displacement is always accompanied by laceration of the perirenal tissues, which is manifested by distinct local and general symptoms. Severe injuries involving the kidney or perirenal tissues are seldom or never followed by movable kidneys. A movable kidney is never the immediate result of a single trauma. M. L. Harris (*Jour. Amer. Med. Assoc.*, Feb. 13, 1904).

**Treatment.**—In a very few cases the application of a suitable abdominal support is all that is necessary; if it proves unavailing, operation should be considered.

Besides a serviceable, well-fitting abdominal bandage (a cushion for the kidney can almost always be omitted), the medical treatment consists in promoting the nutrition and strengthening the organism. The former is done by a liberal diet (forced feeding), so that an increase in weight takes place. The latter is accomplished by gymnastics, by general massage, and electricity. In a few cases, after a considerable increase in flesh has occurred, there is not only a disappearance of all the subjective symptoms, but also the return of a previously movable kidney in the second or even third degree to its normal position, so that the organ can no longer be palpated.

Personal experiences point decidedly in favor of medical treatment. While, in general, operative treatment in cases of floating kidney is opposed, still in rare instances nephrorrhaphy may be justifiable especially when a connection between the symptoms (both the direct as well as the gastro-intestinal disturbances) and a movable kidney ap-



pears to be proved in a high degree, and the above-described dietetic-mechanical methods of treatment have completely failed. Every surgeon, before advising operative intervention in movable kidney, should completely exhaust the suggestions and remedies of the physician. Einhorn (Med. Record, Aug. 13, '98).

When in movable kidney in children the affection is latent or well borne, rest and an abdominal belt may suffice to relieve the symptoms. A flannel bandage wound several times around the body and supporting the abdomen is the best means of immobilization that can be devised. Dyspepsia and constipation should receive careful treatment. In the event of persistent unbearable pains, peritonitis and hydronephrosis from twisting of the ureter, an operation should be performed, fixing the kidney to the posterior abdominal wall. Jules Comby (Brit. Med. Jour., Oct. 15, '98).

From 90 to 95 per cent. of symptomatic movable kidneys can be relieved symptomatically by the judicious use of the corset. Those cases in which the kidney is at the pelvic brim, as a rule, give the least trouble. Fixation only transfers the weight from the vascular pedicle to a cicatrix. This treatment does not achieve all that is desired. Mechanical means are superior to operative procedure. Belts and pads have their advantages. The prevailing style of corset is a good one and should be as long in front as can be worn. A corset 2 inches smaller than the size usually worn should be selected. The lacing should be from below upward, pushing the kidney well up beneath the ribs before fastening the upper hooks. The corset should be fastened on before the patient rises in the morning. Great attention should be paid to the general health of the patient. A. Ernest Gallant (Phila. Med. Jour., Apr. 27, 1901).

Bandages for movable kidney are of two kinds: simple bandages and apparatus with some special kidney pad. Simple bandages act by supporting the whole abdominal contents, thus helping to fix the movable kidneys by pressing the intestines upon them. This result can be obtained either by simple band-

ages or by long-fronted corsets. The association of enteroptosis is necessary for bandages to afford any relief. When movable kidney exists without concomitant enteroptosis, no form of bandage does any good.

All kidney pads are useless, for they cannot fix or sustain a movable kidney, and may exercise an injurious pressure on the kidney or vermiform appendix, or both. Nephropexy is indicated in all cases in which a simple bandage or corset does not give relief. Edebohls (Medical Record, May 4, 1901).

**OPERATIVE PROCEDURES.**—*Nephropexy or Nephrorrhaphy.*—By this term is meant the operation for fixation of a movable kidney. The operation was first performed in 1881 by Hahn, of Berlin, who operated upon two cases of movable kidney in April of that year.

Before the introduction of nephropexy, nephrectomy was performed for the relief of movable kidney; but at present it would only be considered justifiable in case of some severe complication, such as strangulation or suppuration.

Out of 374 operative cases of movable kidney but 7 deaths occurred within four months of the operation. In 4 instances only could death be attributed to the operation. As regards relief of symptoms, the results were successful in 78 cases out of 100 in which intraparenchymatous sutures were employed. Nervous symptoms were, however, less often relieved than painful ones, 14 out of 100 being partially relieved, while 36 out of 100 received no benefit in this particular. With respect to pain, nephrorrhaphy was successful in 88 cases out of 100. Albarran (Gaz. Méd. de Paris, Sept. 14, 21, '95).

The following method of fixation for loose kidneys recommended: A flap of capsule, including the larger part of the mesial surface of the kidney, is incised with a scalpel and the flap of capsule then stripped up from the parenchyma, but remaining attached to the convex border of the kidney. The flap of capsule is drawn through a slit in the psoas

muscle of the quadratus. This brings the parenchyma also in contact with the psoas or quadratus fascia, where it forms a firm connective-tissue attachment. The operation avoids the necessity of passing sutures through the renal parenchyma. R. T. Morris (Med. Record, Feb. 23, 1901).

New method of anchoring the kidney. The incision extends from the lower rib to near the crest of the ilium, a hand's breadth to the right of the spinous processes of the vertebræ. The fatty capsule is reached just anterior to the outer border of the quadratus lumborum, and is opened and a large part of it trimmed away. The kidney is pushed into place by a cylindrical pad placed under the abdomen. When the kidney is well exposed, an incision is made through the proper capsule from one process below the upper pole to a point two centimetres above the lower pole. This incision is placed vertically on the posterior surface near the convex border. The capsule is stripped loose from the kidney substance from a distance of three-fourths inch anteriorly and posteriorly to the incision of the capsule. From the upper and lower extremities of the vertical incision a perpendicular incision three-fourths inch long is made through the capsule, this giving two flaps of capsule three-fourths of an inch wide by about two and one-half inches long. Next a strip the thickness of one's little finger of the other border of the quadratus lumborum muscle is split off from the remainder of the muscle, the fibres being separated by the handle of the scalpel. This separation extends from the muscular attachment to the twelfth rib downward for two and one-half inches, or the slit in the muscle is made as long as the length of the capsular flaps before described. Next, an artery forceps is passed through the slit in the muscle, made to grasp the free border of the posterior flap of the kidney capsule, and then withdrawn, bringing the flap of the kidney capsule through the slit in the muscle. The two capsular flaps are next brought together over the bundle of muscular fibres thus isolated from the border of the quadratus lumborum, and stitched together with a run-

ning suture of fine chromated catgut, the needle being allowed to penetrate the muscular bundle at two or three places. The lumbar wound is next closed by tier sutures of catgut, the skin wound being closed with horsehair. B. G. Davis (Amer. Medicine, Jan. 11, 1902).

In neurasthenic cases nephropexy may do good. Vomiting and other gastric symptoms can certainly be cured, but if dilatation of the stomach is present, a guarded prognosis must be given. One must be most cautious in concluding that a movable kidney is the cause of obscure abdominal symptoms. Movable kidney occasionally causes symptoms which exactly simulate those due to gall stones, but, seeing that the coincidence of movable kidney and gall stones is not uncommon, it would be unwise merely to fix the kidney without a preliminary examination of the gall bladder and ducts. While many cases of movable kidney cause no symptoms and require no operation, there remain many which do cause symptoms, and in a fair proportion of these an excellent result from nephropexy may confidently be expected. Gordon (Lancet, June 6, 1903).

*Technique of Nephropexy.*—The patient is placed on the side, resting on a hard pillow or pad, so as to increase the costo-iliac space. The incision for nephropexy answers also for nephrotomy, nephrolithotomy, and nephrectomy. The twelfth rib is carefully located by both palpation and counting, to avoid the possibility of opening the pleura. Beginning half an inch below the last rib and close to the outer border of the erector spinæ, the incision is carried obliquely downward and forward for about 7 to 8 centimetres (3 inches). It divides the skin and subcutaneous tissues, the superficial fascia, the latissimus dorsi, the external oblique, the internal oblique, the transversalis with its aponeurosis, and the deep layer of the lumbar fascia. The anterior border of the quadratus lumborum may require division if im-



possible to retract it sufficiently. Broad retractors are now made to gather up all the divided tissues, and the perinephric fat will bulge in the wound. The fat is separated by the fingers or by two pairs of dissecting forceps and the fibrous capsule is exposed. The kidney is pushed well upward and into the loin by the hand of an assistant pressing on the abdominal wall. Special care should be taken that the kidney be in its normal position. The kidney is secured by passing four to six sutures through the capsule and about 2 centimetres (1 inch) of kidney-substance and then through the adjacent fascia and muscles of the wound, tying subcutaneously. Fine silk, kangaroo-tendon, and chromicized catgut are used as suture-material; but, if catgut is used, it should be made certain that it is not too readily absorbable.

After the kidney is firmly fastened in place the external wound is closed and the usual aseptic dressing applied.

Various modifications of this operation have been suggested, having, as their main object, the securing of firmer or more general adhesions about the kidney.

Leaving a drainage-tube along the convex border of the kidney for some time, packing the wound with gauze, incising and stripping back the capsule so as to get a raw surface in contact with the surrounding parts may be mentioned as prominent among these procedures, but simply stitching the kidney in place, as described, has given perfectly satisfactory and permanent results in the experience of several prominent surgeons. While the oblique incision is generally recommended, a vertical incision along the sacro-lumbalis muscle permits of more ready access for the purpose of sewing the kidney in its normal axis.

Vulliet's method performed ten times with satisfactory results. It consists in

the fixation of the kidney by means of a detached strip of the tendon of the erector spinæ passed through the parenchyma of the kidney. A small swivel fixed to a long delicate handle facilitates the separation of the fasciculus of the tendon. Two longitudinal incisions are made in the fibrous capsule of the kidney, one near the outer border of the organ and one near the hilum; the capsule is then freed from the parenchyma by blunt dissection, and the split tendon of the erector spinæ is passed beneath the separated capsule from without inward, the ends being secured in a wound near the spine. A few sutures are passed through the capsule and the fascia lumborum. J. L. Thomas (Brit. Med. Jour., Nov. 8, 1902).

### Renal Calculus.

**Symptoms.**—Pain and hæmorrhage are the most important symptoms, in case the stone is small and the kidney healthy; indeed, these may be the only symptoms present. The pain is usually felt in the loin over the affected organ; it is of a dull, heavy, dragging character. Hæmaturia is generally remittent, the amount of blood passed is not great, it is thoroughly mixed with the urine, and the blood-cells are altered. A larger calculus, producing suppuration, is suggested by pus in the urine with pain on pressure and perhaps increased resistance in the loin. A calculus blocking the ureter and producing hydronephrosis is suggested by feeling a soft, elastic tumor of variable size through the abdominal walls or in the lumbar region; but this is apt to disappear simultaneously with the passage of a large amount of urine. The attacks usually recur and the urine becomes alkaline or putrid. Vesical irritation, pain, retraction of the testes, and gastric disturbances are other symptoms frequently met with in all forms of renal calculus. In case of renal colic there is acute suffering, the pain shooting down the ureter to the testicle or labium majus

and often radiating to the thigh. There may be nausea and ineffectual vomiting, vesical tenesmus, faintness, cold sweating, and even collapse. Oftentimes the pain ceases as suddenly as it began; but relief is not permanent unless the stone has receded into the pelvis of the kidney or has passed into the bladder. The paroxysms of pain recur at intervals of from a few minutes to several hours or days.

**Diagnosis.** — In the differential diagnosis from stone and malignant or villous growths of the bladder the imperfect mixing of the blood with urine, the larger amount of blood, less altered blood-cells, the presence of clots, and more severe pain would be of aid. In the case of malignant growths of the kidney the cachexia and the palpation of a tumor, possibly irregular in outline, are of use in establishing a diagnosis.

The Röntgen rays have been used by a considerable number of surgeons, and with quite satisfactory results in most cases. Calculi of calcium oxalate give the most distinct pictures, those formed of urates are less easily recognized, and phosphatic calculi are most difficult to photograph.

Localization of pain in renal lithiasis, based on analysis of 259 cases of renal calculus. The simple cases, those who did not suffer crises of colic, were generally characterized by pain corresponding almost exactly to the situation of the kidney. In 75 cases bilateral lumbar pain was present, and often constituted the only symptom of calculus. Unilateral lumbar pain occurred 15 times, generally in attacks of colic, and associated with other manifestations. Abdominal pain, which, in infants, involves the whole abdomen, and is the chief factor in renal colic, was found in adults most acute in the hypogastric and umbilical regions. Abdominal pain occurred alone in 7 cases of the series; associated with lumbar pain, but with-

out true colic in 26, bilateral in 9, unilateral in 17. Pain in the ureter alone was observed in 10 cases, unilateral in 6, bilateral in 4. Of these 10, 9 were proved to have been caused by oxalate calculi. Hepatic pain, without gallstones as an accompanying condition, was present twice. Genital pains are recorded in 15 cases, bilateral, and always associated with other localizations. Pain was found once over the iliac bone, unilateral 8 times in the thigh, 6 times in the area of distribution of the femoro-cutaneous nerve, twice in that of the obturator, and twice in the urethra. Apart from pain, total abdominal hyperæsthesia was observed in 2 cases, and abdominal analgesia in 5, of which 4 were unilateral, involving the hypochondrium especially. True colic, paroxysmal lumbar pain extending to the thorax and along the ureter, with vomiting of food and bile, was seen in 74 cases. Constant (*Brit. Med. Jour.*, from *Rev. Méd. de l'Est*, Jan. 1, 1901).

**Etiology and Pathology.**—Renal calculus occurs most frequently in males, before the age of 15 and in later years of life. Its formation depends upon the gluing together of crystalline particles or amorphous salts in the urine by colloid material from blood-clot or mucus. The masses thus formed vary in size from sand to that of a hen's egg; some of them assume the shape of branches of coral. The nuclei of calculi are said to consist most commonly of ammonium urate in children, uric acid in adult life, and calcium oxalate after the fortieth year. The phosphates, cystin, and xanthin less frequently give rise to renal calculi.

A small stone may be lodged in healthy renal tissue, giving rise, perhaps, to bleeding, congestion, and inflammation and various nervous symptoms; or it may cause the formation of an abscess in the substance of the kidney. Gravel may pass from the uriniferous tubules and be carried away by the current of urine with-



out causing symptoms. A small stone may pass along the ureter with difficulty, causing renal colic; it may remain a movable body in the pelvis, by its irritation producing pyelitis or by stopping the ureteral orifice produce hydronephrosis; or it may be lodged in the pelvis or calices, forming a large, sometimes branched, calculus and give rise to inflammation, suppuration, and thickening of the tissues about it.

**Treatment, Medical.**—During the attack of colic the patient is to be given the hot bath and hot drinks of lemonade or soda-water, while hot fomentations are to be applied to the loins. If these measures are insufficient to bring relief, morphine or even chloroform may be used.

Between the attacks attention must first be directed to hygienic and dietetic measures. Moderate exercise is to be taken daily in the open air and the patient is to lead as quiet and temperate a life as is possible. Overeating and indulgence in alcohol should be prohibited. Large quantities of water, either mineral—such as lithia, Poland, Carlsbad, and Vichy—or distilled, are to be taken daily. The bicarbonate or citrate or potassium given in 1-drachm doses in a tumblerful of water two or three times daily, or the benzoate or carbonate of lithia in 5-grain doses three times a day are of value. Piperazin is claimed by some to be a solvent for uric-acid calculi and may be exhibited in 5-grain doses three or four times daily.

On theoretical grounds based on the facts that glycerin is a solvent of uric acid, and that when given by the mouth it is excreted in large part with the urine, this agent was tried with success, but it is not due to any solvent action on the uric acid, but to physical changes produced in the urine, which is rendered somewhat oily and thus causes a lubricating effect. From 1 to 4 ounces are

given at a dose, dissolved in an equal quantity of water, between two meals, and repeated two or three times in several days. This method was used in one hundred and fifteen cases, and in 60 per cent. it proved efficacious either by removing concretions or by relieving the pain. Herrmann (*Med. Chronicle*, Jan., 1900).

**Treatment, Surgical.**—Nephrolithotomy—the removal of a stone located in the substance, calices or pelvis, of the kidney—is indicated when the diagnosis is reasonably certain.

*Technique of Nephrolithotomy.*—The preparation of the patient and the incision are the same as for nephropexy. Edebohls's bag, placed under the patient lying on the side, is of much value in bringing the field of operation into prominence. Deep manipulation is facilitated by dividing the outer edge of the quadratus lumborum or if more room is needed in front, for inspecting or freeing the kidney or for controlling hæmorrhage. The incision may be curved downward and forward toward the abdomen. After opening the fatty capsule of the kidney the organ should be systematically examined by pressing on its surfaces or compressing it between the thumb and fingers. Morris recommends that the pelvis and upper end of the ureter be palpated before the kidney is disturbed in its position in order to detect any small calculus that might be present and prevent its falling into the ureter during manipulation. If no hard spot is detected after the entire kidney has been squeezed between the fingers, some operators recommend that exploratory punctures be made from one end of the kidney to the other with a fine needle. This procedure is to be condemned as most unreliable for diagnostic purposes.

In case a stone is found, the kidney must be opened; and if none be found the

same procedure is necessary for thorough exploration. In either case an incision should be made in the border, the infundibulum should be opened, and the calices should be subject to digital examination. When a calculus is found, it may be necessary to enlarge the wound in order to extract it. Hæmorrhage is controlled by temporary packing or by passing a catgut suture through the kidney-substance. Large calculi, particularly if branched, often have to be broken with forceps before it is possible to remove them. Openings in the pelvis sometimes give rise to urinary fistulæ; when, therefore, it seems proper and feasible, it is best to extract through an opening into renal tissue.

Whether a calculus is found or not, the ureter should be catheterized through the pelvis of the kidney from end to end, to determine that it is not obstructed. Weir's long flexible probe of spiral steel is the best means of accomplishing this. When the renal cavity is suppurating, it should be irrigated with a weak antiseptic solution. The wound in the kidney is packed with iodoform gauze and a drainage-tube is carried behind the kidney passing out of the lower part of the incision. The wound is partly closed and dressed with the usual aseptic precautions.

Probably no major operation has a lower mortality, particularly if undertaken early before any serious renal changes have resulted.

[Morris has operated in 34 cases with only one death. Newman ("Lectures on the Surgical Diseases of the Kidney," London, '88) collected statistics of 42 cases of nephrolithotomy in which the calculus was not associated with pyuria or suppuration within the kidney, without finding a single death. KEEN and TINKER.]

Cellulitis, renal fistula, and renal abscess have been mentioned as possible consequences of the operation.

### Tumors of the Kidney.

The greater number of tumors of the kidney are malignant. Sarcoma, however, is much the most common form; carcinoma comes next in order; adenoma is not uncommon and is said to degenerate frequently by epithelial overgrowth into carcinoma; fibroma, lipoma, angioma, myxoma, and tumors of the adrenal are much more rarely observed.

In 24 cases of tumor of the capsule of the kidney, 20 were in women. In 15 the normal kidney was removed with the tumor. The tumors of the capsule are fibrolipomata, myxolipomata, and, rarely, sarcomata. The former are benign, the second semimalignant, and the last malignant. Bork (*Archiv f. klin. Chir.*, vol. lxiii, No. 4, 1901).

SARCOMA is by far most frequently met with in children and is usually congenital. The tumor is generally of the round or spindle-celled variety, highly malignant, of rapid growth, and often attains enormous dimensions.

CARCINOMA is said to result in some cases from traumatic irritation, as from calculi, or to follow inflammatory processes. As a rule, the tumor is of slow growth, and the neighboring lymphatic glands are not affected until late. Extension of the disease to surrounding organs is not common and metastases are still more rare. All these factors favor the success of the operation. If a malignant growth be large and of some months' standing, however, particularly if it is adherent, operation is contra-indicated, as it is also in children unless the growth be small and the child otherwise healthy.

Malignant tumors of the kidney in childhood occur either congenitally or within the first four years of life; most frequently between one and two years



of age. All of them are probably embryonic in origin, as evidenced by the fact that they contain distinctly embryonic tissue. They are very rapid in growth, and are not attended with any destructive systemic symptoms in the first half of their course; in the late period they are accompanied by rapid and great constitutional disturbance. The left kidney is more often affected than the right. There is no sexual variation. Without operation the average duration of life is 8.08 months; with operation it is 16.77 months. George Walker (*Annals of Surg.*, Nov., '97).

Pathological anatomy of a case of primary carcinoma of the kidney exhibiting two main points of interest: metastasis by the venous channels, and extension in directions opposite to that of the blood-current. A man, aged 56, was admitted with a large growth in the left loin. The growth was inoperable. Post-mortem a renal new growth was found, with metastasis in the renal pelvis, in the spermatic cord, testicle, and penis by extension along the internal spermatic vein and the venous channels with which this vein communicated. In this way the vessels of the prostate and base of the bladder, of the venous sinuses of the corpora cavernosa, and of the dorsal vein of the penis were involved. The primary growth was of an adenocarcinomatous nature; the secondary, in addition to this, exhibited papillomatous characters. Sutter (*Virchow's Archiv*, May 28, 1902).

**Symptoms.**—The most important symptom of renal neoplasms is the presence of a tumor, situated in the loin and growing anteriorly. The tumor is smooth and rounded, resists movement on pressure, and does not descend on inspiration. Pain is quite a constant symptom in the case of malignant growths. It is felt chiefly in the loin, but radiates to the scapula and back and to the thigh. Hæmaturia may be a symptom, particularly in case of sarcoma, and is irregularly intermittent. Carcinomatous tumors are apt to be nodulated instead of smooth and rounded, as are most renal

tumors. In advanced stages of the disease fragments of carcinomatous tissue may be passed in the urine. The patient becomes emaciated and cachectic. Hepatic and splenic enlargements are most likely to be confounded with renal tumors.

**Diagnosis.**—The differential diagnosis is facilitated by noting the resonance of the colon, which crosses the kidneys, but not the spleen or liver. This is assisted by the detection of the notched edge of the spleen or well-defined edge of the liver; and of dullness on percussion over the flanks. Soft, elastic sarcomata may be mistaken for hydronephrosis.

Researches into the literature of renal tumors have served to show that the large intestine does not always lie in front of such growths, but that it may be placed laterally or even retain its normal relationship to the kidney. In analysis of 34 cases of right- and of 27 cases of left-sided renal tumor the percentage frequency of the position of the gut found as indicated in the subjoined table:—

	Normal.	Lateral.	Anterior.
Right .....	44.12	11.5	44.13
Left .....	37.02	22.2	40.78

Kofmann (*Wiener med. Woch.*, Nos. 26 and 27, '96).

The chief symptoms of renal sarcoma in children are the presence of a tumor behind the colon, rapidly growing, more or less free according to the presence or absence of adhesions; if cysts develop, examination of the fluid is a help in diagnosis. Examination of the urine gives negative or uncertain results; hæmaturia is exceptional. Concetti (*Rif. Med.*, May 9, 10, 11, '98).

### Diseases of the Ureters.

**EXAMINATION OF THE URETERS.**—*Inspection.*—The vesical orifices of the ureters can be seen by cystoscopical examination, but for more extensive examination vaginal or abdominal incision is required. For exposing the vaginal portion of the ureter Kelly makes an in-

cision extending from the vault half-way down through the antero-lateral vaginal wall. The posterior pelvic portion and lower abdominal portion is exposed after abdominal incision by drawing the sigmoid flexure toward the right to expose the left ureter and by lifting the caput coli and drawing it also to the right to expose the right ureter. The abdominal portions are exposed by incising the peritoneum reflected over the ascending or descending colon on the outer side where there are no vessels, and then displacing the colon toward the median line. The ureter will often be found adhered to the peritoneum as it is separated from the abdominal wall.

*Palpation.*—The pelvic portion of the ureter may be palpated through the vagina or rectum. If the internal iliac artery can be located the ureter will be felt as a flat, yielding cord lying behind and close to it in the upper part of its course. In the lower part of its course it is distinguished by its direction, size, consistency, and mobility. It is said to be sometimes possible to palpate the normal ureter through extremely thin abdominal walls as it passes over the brim of the pelvis. In case the ureter is thickened or if it be distended or sensitive from disease, it can be much more readily found, and it may be possible to palpate it in any part of its course.

*Catheterization of the ureters* was practiced by Simon, of Heidelberg, in 1875, but with only qualified success. (Samm-lung klin. Vort., No. 28; Gynäk., p. 649, No. 88, of entire series.)

It is chiefly through the work of Howard A. Kelly that this most important means of investigation has been simplified and brought into general recognition, and it is not only a means of diagnosing disease of the ureter, but a most valuable aid in determining the

exact condition of the renal pelvis or of the kidney, in treating disease of the pelvis of the kidney, and in accurately locating the ureters so that they may be avoided in pelvic or abdominal operations.

A general anæsthetic is not necessary unless the patient is very nervous. After having emptied the bladder the woman is placed in the knee-chest position or in the dorsal position with the hips elevated. In case it is necessary to dilate the urethra, its sensitiveness is first dulled by the introduction of a pledget of cotton saturated with cocaine, then a well-lubricated, conical dilator is inserted with a boring motion until a dilatation of one centimetre in diameter is reached. A cylindrical speculum provided with an obturator is then introduced, the obturator is withdrawn, and air immediately rushes in and distends the bladder.

Light is directed through the speculum into the bladder by a head-mirror and the speculum is withdrawn a little and moved right or left until the ureteral orifices are brought successively into the field. The orifice usually appears as a little transverse slit, with a slight horseshoe-shaped elevation around it, open on the inner side. Sometimes it appears as a pit or hole in the mucosa or as a rosette with an opening in the centre. If the observation is continued a little jet of urine will spurt from the orifice for a second or two.

The catheter is passed through the speculum until its point rests in the ureteral slit, and it is pushed gently in and toward the side, stopping at once if the slightest resistance is met. The catheter can be introduced even into the pelvis of the kidney and the renal pelvis can be irrigated. Kelly ("Operative Gynæc.," volume i, p. 451, '98) has used a flexible ureteral catheter tipped with



wax, which is softened by olive-oil, in the diagnosis of calculus in the pelvis of the kidney. The stone makes scratches on the glistening surface of the dental wax which are readily seen with a hand-lens.

**Calculi in the ureter** are found most frequently at the junction with the renal pelvis; less commonly about the middle and at the entrance to the bladder.

**SYMPTOMS.**—Calculi in the ureter usually give rise to attacks of renal colic, whether they simply pass without impaction or become arrested in their course. Impacted calculi are apt to give rise to hydronephrosis, particularly if imbedded near the renal pelvis. At times there is pain or tenderness on pressure at some point in the course of the organ. In the lower part of the ureter a stone may sometimes be felt by the finger in the rectum or vagina. A positive diagnosis can often be made only by *cœliotomy* and direct palpation.

Through the roof of the vagina a calculus can be felt at any spot within the last two and a half inches of the ureter. Through the rectum not more than one and a half inches of the ureter is thus under control.

The passage of a calculus along the ureter should be suspected if attacks of pain and hæmaturia and other symptoms suggestive of renal calculus have extended over several days or weeks or months and if, with each succeeding attack, the pain and tenderness on pressure are located lower and lower down along the course of the ureter, and the bladder at length becomes the seat of pain and irritability. So also should suspicion be aroused if, after one or more attacks of typical renal colic, the patient is suddenly seized, after walking or some exertion, with a violent pain shooting along the course of the ureter and followed by settled pain and great tenderness at one particular spot in this course, lasting days or weeks uninterruptedly. Henry Morris (*Lancet*, Dec. 16, '99).

Conclusions based on a study of 134 cases of calculus in the ureter: Inter-

mittent pain on one side, with varying amounts of red blood in the urine, are constant symptoms of stone in the ureter. Though the best means of locating stones, the x-ray cannot yet give evidence sufficient in itself to warrant us in operating or refusing to operate on certain cases. If a calculus starts from kidney to bladder, it is likely to catch within an inch of one of three places, all of which are accessible to the surgeon through extra-peritoneal openings. A single calculus is the rule, but the exception occurs, according to these cases, about once in eight times. The opening in the ureter or kidney pelvis for removal of the calculus should be sutured if possible. Both sorts of suture materials have been used with equally good results, and wounds in both locations apparently heal equally well. The recovery is only delayed if sutures are not used. A calculus in the ureter is a menace not only to health but to life, and its removal is an operation of low mortality, provided it is undertaken before secondary changes appear in the kidneys. Benjamin Tenney (*Boston Medical & Surgical Journal*, Feb. 4, 1904).

**TREATMENT.**—The treatment of calculi passing through the ureter is that already described under renal colic. In case of impaction incision into the ureter, ureterotomy, is the only means of relief and cure.

**Ureterotomy.**—In 1879 T. A. Emmet (*"Principles and Practice of Gynæcology,"* p. 744, Philadelphia, 1879) reported three cases in which he had found calculi obstructing the ureter; in one case he removed the stone by forceps after opening the bladder and in another he removed a stone weighing 98 grains by incision through the vaginal wall. Since these operations a considerable number of calculi have been removed from various parts of the ureter. Stones impacted in the vesical portion may sometimes be removed with forceps after suprapubic cystotomy has been

performed; in other cases a small incision with careful dilatation of the orifice will be necessary. From the lower pelvic portion of the ureter stones have been removed by incision through the vagina and through the rectum, but removal through rectal incision is to be condemned because of the danger of infection.

Stones located higher in the pelvic ureter are removed, preferably after cœliotomy, as the extraperitoneal method requires too extensive denudation. Calculi have been removed from the middle portion of the ureter by both retroperitoneal and intraperitoneal ureterotomy; the retroperitoneal method is the method of choice, exposing the ureter in the way described under examination of the ureter. The upper part of the ureter is reached in the same way as the kidney. In some cases in which the stone is lodged high up it may be possible to push it up into the pelvis of the kidney.

**Stricture and Valvular Obstruction.**—The symptoms of this condition are those due to interference with the free flow of urine. Hydronephrosis accompanied by more or less pain has been present in the cases thus far reported; decomposition of the urine, with irritation of the bladder and frequent micturition is common.

Case of intermittent ureteral obstruction. The obstruction was apparently due to some local inflammatory action which had taken place early in life, and which had resulted in small, adhesive bands surrounding the ureter at its location just under the tip of the seminal vesicle, binding the vesicle to the ureter and to the bladder. Subsequently the mucous membrane hypertrophied, forming a valve. The ureter was dilated to  $1\frac{1}{4}$  inches. The mucous fold was divided and a No. 6 gum catheter allowed to remain in the ureter two weeks. In order to accomplish this, the patient was

subjected to three operations. Recovery ensued. Morgan (*Annals of Surg.*, Oct., 1902).

**TREATMENT.**—Kelly has seen great improvement follow gradual dilatation by graduated hollow bougies in cases of stricture. Ureterotomy and division of the valve or, in case of stricture, closing the opening after the Heinecke-Mikulicz method of suturing the pylorus has been successful in relieving these conditions in a number of cases. Resection and anastomosis or suturing the ureter into the lower part of the infundibulum is sometimes necessary.

#### **General Surgery of the Kidneys.**

When operative procedures are about to be performed on the kidney, the fact that it is occasionally the seat of anomalies should be borne in mind. It may occupy an abnormal position; under such circumstances it will usually be found below and nearer the middle line than usual. It may even be found as low as within the pelvic cavity. Irregularities of size and shape may also be found, due to abnormal or arrested development.

Sometimes the extremities fuse, forming "horseshoe kidney" or one kidney may be wanting, in which case the other is apt to be of unusual size. A number of cases of congenital occlusion of the ureter have been reported in which it was, of course, impossible for the kidney to fulfill its function.

#### **Renal Decapsulation.**

The proposal to treat chronic Bright's disease by operation was first made by Edebohls (*Medical Record*, Dec. 21, 1901). The diagnosis of chronic Bright's disease in 18 cases was based upon the previous history of the patient, upon the chemical and microscopical examination of the urine, and lastly, upon the critical test of actual inspec-



tion and palpation of the kidney at the time of operation. This evidence was supplemented in 2 cases by microscopical examination of a small piece of kidney tissue removed at operation. The evidences of chronic Bright's disease, as revealed by operation, clinched the diagnosis beyond peradventure in all the cases. They were, in each instance, so positive and pronounced as to leave no room for doubt.

Excision of the renal capsule proper is performed as follows: The patient is placed prone upon the table, with the author's kidney air-cushion underlying and supporting the abdomen. Both kidneys are thus rendered accessible to operation without the necessity of changing the patient's position. An incision is carried from the twelfth rib to the crest of the ilium along the outer margin of the erector spinæ, without opening the sheath of that muscle. The fibers of the latissimus dorsi muscle are bluntly separated in the direction of their course, without cutting. The iliohypogastric nerve is sought for and drawn to one side or other, out of the way of harm. Division of the transversalis fascia exposes the perirenal fat. This is divided over the convexity of the kidney until the capsule proper is reached. The fatty capsule is now bluntly separated everywhere from the capsule proper, the dissection advancing on either aspect and around both poles of the kidney until the pelvis of the kidney is reached. Now and then the fatty capsule may be found so thickened and adherent, as the result of chronic perinephritis, that the scissors or knife may be required to separate it from the capsule proper. The kidney with its capsule proper is next lifted from its fatty capsule bed, and if possible delivered through the wound. The capsule proper is divided on a director

along the entire length of the convex external border of the kidney and clean around the extremity of either pole. Each half of the capsule proper is in turn stripped from the kidney and reflected toward the pelvis until the entire surface of the kidney lies raw and denuded before the operator. In separating the capsule proper from the kidney, care must be exercised not to break or tear away parts of the kidney, which is often both very friable and very firmly connected with its capsule proper. The stripped-off capsule proper is next cut away entirely, close to its junction with the pelvis of the kidney, and removed. Delivery of the kidney makes this otherwise difficult work easy. If the kidney cannot be delivered, the capsule proper must be entirely peeled off the kidney by the fingers in the bottom of the wound, and excised as far as possible, any remaining portion being simply reflected backward around the root of the kidney, where it will curl up and stay. The kidney is dropped back into its fatty bed and the external incision is closed. Drainage, except when the parts are extremely œdematous, is dispensed with. After both kidneys have been thus operated upon, the dressings are applied and the patient is put to bed.

There has thus far been no mortality in Edebohls's operations upon the kidneys of patients affected with chronic Bright's disease. All the patients recovered from the operation, and all but two are alive to-day. One of the two died after operation for ruptured tubal pregnancy, performed by another surgeon, exactly one year after operation on her kidneys; the other succumbed to a hysterectomy, also performed by another surgeon, eight years after operation on her right kidney.

Of the 8 patients observed from one

year to over eight years after operation, all are cured of their former chronic Bright's disease, and 7 of them (one of the cases died from accident) remain so cured as a result of operation on their kidney or kidneys, none of them having received further treatment of any kind after operation. They are free from all symptom referable to the kidneys, and their urine remains permanently free of albumin and casts.

That chronic Bright's disease is curable by operation is apparently demonstrated beyond any legitimate doubt by the results obtained in these eight cases. The significance of this demonstration or proof becomes apparent when we consider both the wide prevalence of the disease and its inevitable tendency to a fatal termination, delayed though that termination may be, under any and all forms of treatment hitherto known.

Edebohls, however, does not entertain any enthusiastic hopes or expectations that chronic Bright's disease will be found to yield to surgical treatment in all cases and in all stages of the disease. When the patient is practically moribund, sufficient time may not be left for the circulatory changes in the kidneys, initiated by the operation, to produce any good results. The first beneficial effects of operation, as indicated by the increased flow of urine, do not appear before the tenth day. The manifold complications of the advanced stages of chronic Bright's disease, many of them in themselves necessarily fatal, will also stand in the way of our saving lives, even if we succeed in curing or improving the chronic Bright's disease. A number of these complications will, in addition, prove almost prohibitive to undertaking any operation whatsoever.

The increased and adequately maintained blood-supply to the kidney estab-

lished by Edebohls's operation leads, most probably, to gradual absorption of the interstitial or intertubular inflammatory products and exudates, thus freeing the tubules and glomeruli from external compression, constriction, and distortion, and permitting the reestablishment in them of a normal circulation. The result of this improved circulation in and between the tubules and glomeruli is the regenerative production of new epithelium capable of carrying on the secretory function.

Renal decapsulation is performed with the object of creating new and liberal supplies of arterial blood to the diseased kidney. Both the denuded kidney and its fatty capsule are most liberally supplied with blood-vessels; both are brought together by the operation over the whole extent of the surface of the kidney; and the necessary result must be the formation, on the most extensive scale possible, of new vascular connections between the kidney and the fatty capsule embracing it. The fibrous capsule proper forms an almost impenetrable barrier to the passage of blood-vessels between the kidney and its fatty capsule.

Cirrhosis of the liver, chronic interstitial hepatitis, one of the most frequent complications of chronic Bright's disease, has within the past three years come within the domain of surgery. The most modern development of the operation for cirrhosis of the liver embraces, as essential features, both the establishment of anastomosis between the omentum and the anterior abdominal wall, and the creation of widespread adhesions between the upper surface of the liver and the diaphragm. Both operations are performed with the object in view of relieving the portal circulation, and of thus removing one of the symp-



toms of the disease, the ascites. Edebohls believes that the future will show that whereas the anastomosis between the vessels of the omentum and abdominal wall will relieve the ascites, the establishment of broad adhesions and extensive vascular anastomosis between the upper surface of the liver and the diaphragm will accomplish more than this. It will probably lead to an amelioration, and possibly, in some instances, to a cure, of the cirrhosis itself, by establishing an increased arterial hyperemization of the liver on the same principles which underlie the operation for the cure of chronic Bright's disease. There is no good reason, at the present day, why a sufferer from both chronic Bright's disease and cirrhosis of the liver should not have the chance of life afforded by operation for both conditions.

Chronic Bright's disease is curable by operation, and the present state of our knowledge does not warrant us in accurately defining the limits beyond which operation can no longer avail. Edebohls is prepared to operate upon any patient with chronic Bright's disease who has no incurable complication, or one absolutely forbidding the administration of an anæsthetic, and whose probable expectation of life, without operation, is not less than a month. (*Therapeutic Gazette.*)

### **Nephrotomy.**

Nephrotomy is an incision into the kidney, but the term is now generally limited to incisions for the evacuation of cystic or purulent collections of fluid.

**INDICATIONS.**—It may be indicated in simple cysts, hydronephrosis, hydatid cysts, pyonephrosis, suppurative nephritis, and tuberculosis of the kidney.

In all of these conditions pus and blood will be found in the urine. The amount

of blood is generally small and the cells are abnormal; the pus, if measured, is apt to vary in amount. Renal cells and the characteristic epithelium of the pelvis of the kidney will also probably be found. In all chronic inflammatory conditions casts and albumin are present in the urine. Elevation of temperature, with or without chills, loss of appetite, hectic, suppression of urine, and uræmia may also exist. There will be more or less pain and tenderness over the region of the kidney and in pyelonephritis and pyonephrosis there may be considerable swelling, redness, and œdema. The symptoms of pyonephrosis are those of hydronephrosis plus those of suppuration.

**SIMPLE CYSTS** of the kidney begin in the renal cortex and grow toward the surface without affecting the renal tissue, unless they grow to great size, when they may cause pressure-atrophy. They are thin-walled, globular, and of varying size; and they contain a pale, straw-colored, albuminous fluid of low specific gravity. They sometimes contain cholesterolin or blood, and rarely the contents are thick and jelly-like. They usually cause no symptoms except those of a growing, cystic tumor in the loin.

**HYDATID CYSTS** are found more frequently in the kidney than in any other organ except the liver, but are six times less frequent than in that organ. They are usually situated in the secreting substance and tend to rupture into the pelvis without reaching great size. Thinning and atrophy may result, however, from pressure. They may be secondary to hydatid disease of other organs.

**Symptoms.**—In some cases a tumor may be felt on palpation, and fluctuation may be perceptible; hydatid fremitus, as observed in other organs, is rare. If the cyst ruptures into the renal pelvis,

the passage of vesicles through the ureter gives rise to symptoms of renal colic. The presence of vesicles and hooklets in the urine would confirm the diagnosis. Blood and pus may also escape with the hydatids.

**HYDRONEPHROSIS** is a distension of the kidney with fluid, caused by an obstruction to the outflow of urine.

*Symptoms.*—A tumor, rounded or lobulated in form and often fluctuating, may usually be felt in the lumbar region. In case this tumor diminishes in size or disappears at times, especially if the diminution or disappearance is accompanied by a profuse flow of urine of low specific gravity, the diagnosis is almost certain. Severe cases may be accompanied with suppression of urine, and, in case both kidneys are affected, uræmia will occur sooner or later. Pain is a variable symptom; it is influenced by the tension and may be wanting.

*Etiology.*—Its causes are congenital or acquired. Nearly one-third of all cases are said to be due to some abnormal condition of the ureter: impacted calculus, kinks, twists, stenosis, or compression from some abnormality of adjacent structures such as tumors of the abdominal or pelvic organs. Floating kidney is a frequent cause of kinks of the ureter. Among other unusual causes have been mentioned enlarged prostate, phimosis, and retroflexion of the uterus. The fluid within the cyst is never pure urine, frequently containing neither urea nor uric acid: it is usually a clear fluid of low specific gravity containing chlorides and albumin; sometimes it is brownish from the presence of blood; it may be putrid and ammoniacal; rarely it is thick and jelly-like.

**PYELITIS** and **PYELONEPHRITIS** both occur most frequently as the result of secondary infection from some disease

lower down in the genito-urinary tract. If the infection is confined to the pelvis of the kidney it is known as pyelitis; if the kidney-substance is affected, pyelonephritis, and in its typical form it is usually called "surgical kidney." Both kidneys are generally affected, and gonorrhœa is the ordinary cause of the infection. Calculus is also a very common cause of these conditions; or a calculus may form as a result of the inflammation.

**PYONEPHROSIS.**—The suppurative processes in a case of pyelonephritis may go on until the greater part of the kidney-substance is destroyed and only a sack filled with pus remains; this condition is known as pyonephrosis. An after-development of suppuration in hydronephrosis produces the same result.

**RENAL ABSCESS** may result from traumatism, renal calculus, or it may be pyæmic or metastatic in origin. Abscesses of the kidney are located in the cortical substance. They frequently empty through the pelvis of the kidney or they may rupture the capsule, giving rise to a perinephritic abscess in the surrounding cellular tissue. In case there are several abscesses the septa between them may break through, giving rise to pyonephrosis.

**TUBERCULOSIS OF THE KIDNEY** is, in the majority of cases, associated with tuberculosis in other organs. The kidney is enlarged, sometimes very considerably, and cheesy masses are seen in the secretory substance. This condition was formerly known as scrofulous kidney.

*Symptoms.*—There is usually tenderness and swelling in the loin, accompanied by dull aching or dragging pain. Pus is almost invariably found in the urine in large amount; blood is commonly present; and in many cases tubercle bacilli may be demonstrated. Vesical irritation and tenesmus are said to be



very constant symptoms, and are thought to be due to tubercular deposits about the lower end of the ureter and in the bladder-wall. Irregular elevations of temperature, rigors, and sweating occur, and there is loss of flesh and strength. The history and hectic character of the temperature would be of aid in the differential diagnosis from other suppurative affections of the kidney; the finding of tubercle bacilli in the urine would be almost absolutely diagnostic.

Study of 415 cases of tuberculosis of the kidney. Tuberculosis is rarely, if ever, primary in the kidney, and the original focus is in some other organ in more direct contact with the external air in the majority of cases. The presence of the primary focus of disease in the body, even if the disease has been thoroughly eradicated from the urinary tract, makes the ultimate prognosis in these cases doubtful at least. Such foci may remain permanently quiescent, but they may also become excited to activity by a general low condition of the system or by causes unknown to us. Garceau (*Annals of Surg.*, Oct., 1902).

**PERINEPHRIC ABSCESS** in most cases results from the extension of suppurative processes in the kidney itself, but it may follow operative intervention or inflammatory processes in neighboring organs. Not seldom it arises from a local infection of the perinephric tissues.

The abscess tends to burrow along the sheaths of muscles and under the fasciæ of the lumbar region, usually reaching the surface, but sometimes following the sheath of the psoas to the inguinal region, or finding its way through the diaphragm or rarely bursting through the peritoneum.

The symptoms are those of deep-seated suppuration in this region, but the condition is apt to be of particular gravity because of the debilitated condition of the patient from the previous renal sup-

puration and the highly-poisonous character of the mixed pus and urine. The diagnosis may be confirmed by the use of an aspirating needle.

In any of the above conditions the operation *may* be indicated. Small cysts are frequently found in granular kidneys, however, which never demand surgical treatment, and in case pathological changes are far advanced in any of these conditions the operations of resection or nephrectomy may offer the patient the best chance of recovery. Puncture of the kidney and aspiration of the contained fluid is recommended by some surgeons in the treatment of cysts and hydronephrosis, but, if successful, the procedure has to be frequently repeated in most cases and it very often fails to produce a cure or gives rise to infection.

The indications are more positive when there is suppuration in and around the kidney; incision, evacuation of the pus, and drainage are necessary. When the diseased condition has advanced so far as to call for nephrectomy, but in which the strength of the patient is much exhausted, incision and drainage is often followed by such gain in strength and improvement of the patient's general condition as will permit of the successful performance of the more serious operation at a later date. In tuberculosis of the kidney, simple nephrotomy with removal of diseased tissue may be all that is needed; but nephrectomy is often necessary.

*Operation.* — Before all operations of probable gravity examination of the urine is advisable, and if possible the condition of the other kidney should be determined. In order to lessen the danger of infection from the micro-organisms which are commonly found, even in healthy kidneys, Kocher ("*Chirurgische Operationslehre*," dritte Auflage, p. 160,

'97) recommends the administration of 3 grammes (45 grains) of salol a day for several days before the operation.

The usual incision for exposing the kidney (described above) is generally the best. In cases of great enlargement, however, it may be more convenient to make the opening farther forward. In operating for cysts or for hydronephrosis the tissues may be found normal, with the exception of a thinning of the perinephric fat; but in suppurative processes the skin, muscles, and fasciæ are likely to be found vascular and œdematous, and the perinephric fat dense and adherent. A sufficient surface is usually denuded to permit of its being brought to or near the level of the skin, where it is sutured after being opened. Any curdy or stringy material which may be found within abscesses should be curetted away and if there are septa between abscesses they should be broken down. After thorough disinfection of the wound a thick drainage-tube is inserted, the wound is partly closed, and a heavy absorbent dressing applied.

Simple cysts often close primarily, the cavity of an hydatid cyst usually closes after suppuration, and there are a good proportion of cures following nephrotomy for abscess. After operations for hydronephrosis, fistulæ are often left that will not close without a plastic operation or, in some cases, nephrectomy. Resection or nephrectomy is frequently called for after nephrotomy for tubercular kidney.

Statistics of 2100 kidney operations. Of this number 1118 were nephrectomies which have been reported since the first deliberate excision of a kidney in 1869; 399 of the patients were males, and 676 females, while in the remaining 34 the sex was not specified; 817 patients recovered and 301 died, giving an average mortality of 26.9 per cent. During the

first ten years after the operation was introduced nephrectomy was performed on 81 patients, with a mortality of 50.6 per cent.; during the following decade on 483 patients, with a mortality of 34 per cent.; but during the past decade 554 operations gave a mortality of only 17.4 per cent. The mortality of nephrectomy has been reduced from 55 per cent. during the first decade to 19.4 per cent. during the past decade by the abdominal route; and from 43.9 to 17 per cent. by the lumbar route. The mortality statistics of nephrectomy at the present time, therefore, compare very favorably with those of other major operations. A still further reduction in the mortality rate may be expected by earlier operation, more exact methods of diagnosis, and by a proper appreciation of the factors which may cause death.

The extremes of life do not afford a contra-indication to nephrectomy, if good reasons for the operation are present. During the past thirty years 175 children under fifteen years of age have been operated upon chiefly by the abdominal route, with a mortality of only 28.6 per cent., being only 1.7 per cent. higher than for adults during the same period. The mortality for 28 operations on patients over sixty years of age was 39.3 per cent. Schmieden (*Deutsche Zeits. für Chir.*, Jan., 1902).

### Nephrectomy.

Removal of the kidney may be indicated in cases of renal tumor; severe injuries accompanied by serious hæmorrhage, suppuration, or infiltration of urine; renal or ureteral fistulæ; diseased movable kidney; tuberculosis of the kidney, hydronephrosis, calculus, cysts, and suppurative processes in which resection seems unlikely to relieve or cure.

INDICATIONS.—But few well authenticated cases are on record in which this operation was undertaken for injuries of the kidney. Nasse (*Berl. klin. Woch.*, Aug. 22, '96) was only able to find nine cases with seven recoveries. While a successful result may follow without inter-



vention, operation has no doubt often been delayed until too late. Severe hæmorrhage—as evidenced by bloody urine, acute anæmia, and the physical signs of fluid in the abdominal cavity—is an indication for immediate exploratory operation. The same is true in the event of severe secondary hæmorrhage, which sometimes occurs as the result of the rupture of a traumatic aneurism. It is often difficult to decide what to do if the bleeding is less copious, but in any case operation should not be deferred until the patient is too weak and anæmic. In the less severe cases the lumbar incision will answer; in graver injuries the extraperitoneal incision from the tip of the twelfth rib to the junction of the middle and outer thirds of Poupart's ligament will give more room and seems more generally applicable; cœliotomy is called for in case there are signs of hæmorrhage into the abdominal cavity. The ligation of vessels and suturing or the use of the tampon followed by suture may be sufficient in less severe injuries, but nephrectomy is indicated in case a main branch of the renal artery is injured or if there is very extensive laceration and contusion of the renal substance.

The conditions under which nephrectomy is indicated—for renal calculus, hydronephrosis, tuberculosis, cysts, and suppurative processes—have already been discussed.

After nephrectomy the recurrence of the disease in the other kidney is very rare. In fact, the healthy kidney, relieved of the presence of the diseased one, is less disposed to be attacked than before the operation. Ureteral catheterization, notwithstanding the greatest care, may infect the sound kidney. As to diagnosis, when the abnormal constituents are continuously secreted and the general condition of the patient is good, a bilateral lesion may be excluded. List of thirty-nine nephrectomies personally per-

formed with a mortality of 23 per cent., and 16 per cent. among those for pyonephrosis. D'Antona (Il Policlin., Oct. 15, 1900).

*Ureteral fistulæ*, which usually are due to wounds inflicted during operations on the abdominal or pelvic viscera, may necessitate nephrectomy, but the operation seems indicated only in case there is great discomfort or the patient is prevented from following a necessary occupation. In most cases it would probably be possible to perform a plastic operation on the ureter or, failing in this, to implant the end of the ureter into the rectum.

*Operation.*—As a preliminary to the removal of a kidney measures should be taken to determine as definitely as possible whether another kidney exists and whether it is sound or diseased. Numerous devices have been suggested for the purpose of collecting the urine from each kidney separately, many of them depending upon the compression of the ureter by various means, but none of them have proved entirely satisfactory. The catheterization of the ureters (see AFFECTIONS OF THE URETERS) is the most certain method of obtaining separate urines, but much special skill is required for its successful practice. Moreover, practically its usefulness is restricted to women. M. L. Harris (Jour. Amer. Med. Assoc., Jan. 29, '98) has devised an ingenious instrument which has been used with satisfactory results in a number of cases. Its essential features are: a blade which can be introduced into the rectum or vagina and elevated so as to make a water-shed between the ureteral orifices, and a double catheter, the tubes of which are so hinged that after introduction into the bladder they can be separated and turned down one on each side of the septum formed by the rectal blade; the urine

from each side of the water-shed is carried by them to separate bottles.

In some cases it may seem necessary to lay both kidneys free by lumbar or abdominal incisions to determine the presence of both kidneys or the extent of disease in them, as recommended by Edebohls (*Annals of Surg.*, xxvii, p. 425, '98).

The kidney may be removed either through a lumbar or an abdominal incision. Abdominal nephrectomy is usually reserved for those cases in which there is great enlargement of the kidney and for cases of injury in which there is hæmorrhage into the peritoneal cavity. The lumbar incision gives better opportunity for the separation of adhesions, it is extraperitoneal, and permits freer drainage of abscesses if necessary without serious danger of peritonitis, and the general mortality is considerably less than after abdominal nephrectomy.

*Lumbar Nephrectomy.*—The length and direction of the incision depend to some extent on the condition of the organ to be removed. In case the kidney is of normal size or but slightly enlarged and is not adherent, the vertical or oblique incision as described under movable kidney could be used. The incision suggested by König, beginning half an inch below the last rib near the outer border of the erector spinæ and continued first downward toward the crest of the ilium, then curving forward toward the umbilicus, would give much more space for the removal of an enlarged or adherent kidney.

Bergmann carries his incision from the last rib posteriorly downward and forward to the middle third of Poupart's ligament. Kocher uses this form of incision and finds it possible through it to examine the other kidney or the under surface of the liver with his hand in the

abdominal cavity. After determining that the other kidney is sound he sews together the opening in the peritoneum and proceeds with the removal of the diseased kidney.

The structures divided and their relations have already been described under movable kidney. It is generally possible to separate the peritoneum from the surface of the kidney and to push it inward. The organ is then freed from its bed and the larger vessels going to the capsule are tied. Dense adhesions are divided by scissors, but in some cases they may cause so much difficulty that it will be easier to enucleate the kidney from its capsule rather than to separate it from the circumrenal fat. After it is freed the organ is luxated from its bed, care being taken not to make much traction on the pedicle; the structures at the hilum are isolated, a strong silk ligature is passed about the vessels by an aneurism-needle and tied; the ureter is separately doubly ligated and tied, and the pedicle divided. If the ureter contains infectious material it may be divided with the thermocautery. After the pedicle has been carefully inspected in the wound and all bleeding points have been secured a large drainage-tube is placed in the bottom of the cavity and the wound is partly closed by deep and superficial sutures.

*Abdominal Nephrectomy.*—Various incisions have been used: an oblique incision directly over the kidney is recommended by Kocher; an incision through the linea semilunaris is advised by Langenbuch; that through the outer border of the rectus abdominis is preferred by Greig Smith; or the route through the linea alba may be chosen. An incision in or near the median line will facilitate the exploration of the alternate kidney in case manual examination seems neces-



sary, while the removal of an adherent kidney would be easier through the lateral incision. After opening the abdominal cavity the kidney is exposed by tearing through the peritoneum forming the outer layer of the mesocolon, as its inner layer contains the vessels which supply the bowel, and their division might give rise to gangrene of the intestine. The freeing of the kidney from its bed and the isolation and ligation of the vessels and ureter are then carried out in much the same manner as in lumbar nephrectomy.

The mortality of nephrectomy varies with condition of the patient and the pathological condition for which the operation is undertaken. The prognosis in operations for malignant disease, after which nearly 70 per cent. die: The proportion of deaths after operations for tuberculosis of the kidney is about 36 per cent.; recent statistics place the mortality at about 25 per cent. in case of traumatic lesions; the general primary mortality in all cases of nephrectomy is from 35 per cent. to 40 per cent.

Operations on malignant growths so far done 150 times with mortality of 50 to 66 per cent. before 1890, and 20 to 25 per cent. since. Seventeen cases have lived a year or more after operation. Many died of recurrence at subsequent date. Large mortality due to tardy diagnosis. When palpable tumor only symptom, early diagnosis difficult or impossible. When hæmatinuria and palpable tumor, diagnosis from renal colic difficult. Hæmaturia without palpable tumor, diagnosis made by microscope; urine deposits yellowish-gray granular matter, round or spindle cells. Rovsing (*Archiv f. klin. Chir.*, B. 49, H. 2, '95).

Operative treatment in malignant tumors of kidney in childhood, to be successful, should be instituted as early as possible. Operation is followed by an immediate mortality of 38.25 per cent., an ultimate one somewhere between 74.32 and 49.53 per cent.; 5.47 per cent.

of cures; and a lengthening of life by 8.08 months. George Walker (*Annals of Surg.*, Nov., '97).

#### **Resection of a Part of the Kidney.—**

The first partial excision was performed by Czerny in November, 1887, for an angiosarcoma. The operation has been rather rarely resorted to, although there seems to be no doubt that it is a sound surgical procedure and that it is an important advance in the conservative surgery of the kidney to substitute this operation for total nephrectomy when only a part of the kidney is diseased or has been injured.

Abscess-cavities or caseous tuberculous deposits may be scraped out and packed with iodoform gauze or diseased areas or tumors may be excised and the cut surfaces of the kidney sutured.

Bloch reported a case and gave abstracts of ten others which he had collected from French and German literature at the meeting of the British Medical Association in 1896. Morris includes in his tables of his own operations ("The Origin and Progress of Renal Surgery," London, '98) six cases of partial resection. In all of the cases reported by these operators recovery followed. Subsequent nephrectomy was necessary in three cases and renal fistula resulted in one case.

NEPHROPEXY, OR NEPHRORRHAPHY, AND NEPHROLITHOTOMY, being only indicated in special disorders, are described above under the heading of the latter.

#### **Surgery of the Ureters.**

**Ureterectomy.**—The term has been applied not only to the total extirpation of the ureter, but to resections of more than two or three inches of this organ. The operation is indicated in certain cases of tuberculosis of the ureter, hydrups of the ureter, suppuration in a dilated ureter,

and in case of lumbar fistula due to the presence of a diseased ureter after nephrectomy has been performed.

The operation may be primary, when the ureter is removed simultaneously with the kidney; or secondary, when the ureter is removed by a subsequent operation. The extraperitoneal method is usually chosen, through the incision described under methods of examination.

**Uretero-Ureteral Anastomosis.**—This operation is employed to restore the continuity of the duct after accidental division or division during abdominal or pelvic operations; after resection for stricture, ulceration, or sloughing caused by any cause particularly calculus; and after rupture or other injuries due to external violence.

Four methods have been successfully used: direct end-to-end anastomosis; Poggi's end-to-end invagination of the upper into the lower portion of the ureter; oblique end-to-end anastomosis as practiced by Bovée; and lateral implantation, as suggested by Van Hook. End-to-end union has been performed seven times with four cures and three deaths due to other causes than the ureteral operation. Van Hook's method has been used successfully in three cases, by different operators in each case. It is most readily and rapidly performed and is the operation which is now generally preferred. Bovée's method might be employed in case there was great loss of substance. In case more than a third of the circumference of the duct is involved by an injury division and anastomosis would be the preferable method of treatment.

By *Van Hook's method* the lower end of the ureter is ligated and a longitudinal incision twice as long as the diameter of the ureter is made in its wall  $\frac{1}{4}$  inch (6 millimetres) below the ligature. The

upper end is slit up  $\frac{1}{4}$  inch (6 millimetres) and two very small sewing needles threaded on one fine suture of sterilized catgut are passed through its wall from within outward,  $\frac{1}{8}$  inch (3 millimetres) from its extremity, and  $\frac{1}{16}$  inch (1.5 millimetres) apart. These needles are carried through the slit in the lower end of the ureter into and down the tube for  $\frac{1}{2}$  inch (13 millimetres), and are then pushed through its wall side by side. By traction on the catgut loop the upper end of the duct is drawn into the lower portion and the ends of the loop are tied. Although catgut was originally used because its early absorption lessened the danger of the formation of calculus, silk is to be regarded as a safer suture material and no bad results have been reported from its use.

The site of the union is then enveloped in peritoneum, which is stitched in place about it.

**Ureteral implantation** into the bladder, into some portion of the intestine, and on to the skin have been suggested by many operators and by numerous methods. Such operations are undertaken for the cure of ureteral fistulæ, the prevention of fistulæ in case too great injury has been done to the ureter to permit of anastomosis, in case of extrophy of the bladder, and for uretero-uterine and uretero-vaginal fistulæ.

In cases of uretero-vaginal fistulæ Kelly recommends making a vesico-vaginal fistula near by, then inclosing both fistulæ in a circular denudation and suturing the sides together.

**Uretero-cystotomy.**—In this procedure the abdomen is opened and the end of the ureter is freed. An incision is made at a suitable place in the bladder-wall; long forceps are introduced into the bladder through the urethra and are used to pull the ureter through the blad-



der incision, into which it is sutured by fine-silk interrupted sutures.

*Implantation into the bowel* has been performed many times, but infective nephritis has so frequently resulted that the operation is not generally recommended. Fowler (Amer. Jour. Med. Sci., Mar., '98, vol. cxv, p. 270) describes a new method by which he operated successfully on a boy, 6 years old, for exstrophy of the bladder. After opening the abdomen and isolating the ureters, a longitudinal incision 7 centimetres long was made on the anterior wall of the rectum through the serous and muscular coats; the coats were dissected back until a diamond-shaped space on the submucous coat was exposed. A tongue-shaped flap with its base upward was cut in the mucous membrane of the lower half of the diamond. The flap was doubled up, approximating the submucous surfaces and secured with sutures; thus, a flap-valve was secured, both sides of which are covered with mucous membrane. The ureters were then placed in the incision with obliquely-cut ends, presenting on the external surface of the flap, and were secured by a few stitches in the upper half of the diamond; the flap with the attached ends of the ureters was then pushed into the rectum. The gap in the mucous membrane was closed by catgut sutures and then the original wound in the rectal wall was closed by fine-silk sutures. The valve-flap and compression of the circular muscular fibres of the rectum combine to prevent the passage of faeces into the ureter during defecation.

In implantation of the ureters in the rectum the principles of personal method are: 1. The ureters empty into the bowel in the direction of its length and from above downward so that the urine is discharged in the direction taken by the faecal current. 2. The ureters are buried

longitudinally in the walls of the rectum for the distance of an inch or more, so that in the act of defecation the faecal mass will squeeze the calibre of the ureters closed by its pressure on the mucous membrane, and so that pressure is exerted from above downward in the direction of the onward flow of the urine. 3. The ureters are further protected by the muscular coat of the intestine, by being surrounded by the circular fibres of the bowel, which hold the ureters closed during defecation. After the pressure of the faecal mass and of the circular muscular coat is removed, urine retained in the ureters will spurt forth with considerable force, acting as its own cleanser. 4. The implantation is in the lower bowel, which is normally empty save during defecation. The operation is performed with the patient in the Trendelenburg position. The ureters are approximated by fine-silk sutures and the implantation into the bowel is made when the latter is completely empty and secured above the seat of operation by a clamp. The ureters are secured to the fibrous and mucous coats of the bowel by a number of closely-applied sutures of fine catgut or of silk, great care being necessary not to penetrate to the mucous coat of the ureter or to apply sutures so as to constrict the ureters. F. H. Martin (Jour. Amer. Med. Assoc., Jan. 28, '99).

Uretero-intestinal anastomosis: 1. Ureteral implantation into the rectum is always followed by ascending infection. The resulting pyelonephritis is caused by the bacillus coli communis. 2. The primary mortality is very large (84 per cent.), no matter which operation is done. 3. Of 120 dogs operated upon, 90 per cent. died of peritonitis due to leakage of urine or general sepsis and pyelonephritis during the first ten days. 4. Dogs living a longer time died of pyelonephritis, pyelonephrosis, and pyæmia. 5. Dogs which had fully recovered from the operation and the resulting pyelonephritis, and were, to all appearances, in perfect health and vigor again, *all* had granular contracted kidneys, due to induration and cicatrization of diseased areas. The rectum acts as a fair substitute for the bladder in

such cases. 6. Dogs which had fully recovered after unilateral implantation were living by the other kidney. The kidney of the side operated on was atrophic and granular, the result of an early pyelonephritis. The functionally active kidney was of two to eight times the size of the atrophic one. 7. A review of the literature on uretero-intestinal anastomosis in man shows that no better results can be expected in man than in animal experiments. 8. The ureters are frequently dilated, but show very little or no disease, no matter how extensive a pyelitis or pyelonephritis is present. 9. The bladder is always infected by way of the urethra, whether it is emptied at the time of operation or not. A purulent cystitis was found in every case, caused by *staphylococcus albus* and *bacillus coli communis*. 10. Artificial immunity to infection by the so-called colon group of bacteria is the only hope of making uretero-intestinal anastomosis a feasible operation. R. Zeit (N. Y. Med. Jour., May 18, 1901).

**Injuries of the Ureter.**—Aside from the wounds which occasionally occur during surgical operations, injuries of the ureter are exceptionally rare. Three classes of injuries have been reported: subcutaneous injuries by indirect violence through the unbroken abdominal wall, injuries from penetrating wounds of the abdomen, and wounds inflicted during surgical operations. Morris ("Origin and Progress of Renal Surgery," p. 146, London, '98) gives abstracts of eleven cases, out of the twenty-three which have been reported as subcutaneous injuries of the ureter, which he believes may be considered well-authenticated cases.

**SYMPTOMS.**—In some cases there is hæmaturia, which is usually slight and transient. If the rupture has not also torn into the peritoneal cavity, a tumor forms due to the escape of urine into the areolar tissue. The fluid aspirated from such tumors has the characteristics, more

or less pronounced, of urine. As soon as the urine and blood begin to decompose, inflammation and suppuration, with their attendant symptoms, occur. When the injury communicates with the peritoneal cavity, symptoms of peritonitis, which is usually fatal, occur.

If there is at first little or no hæmaturia and no swelling in the loin, and then after three or four weeks, more or less, a swelling forms behind the peritoneum, rupture of the ureter may be suspected. If, many months or even years after an injury in the region of the ureter, a tumor of the kidney is formed, though there has been an absence of symptoms or only slight hæmaturia at the time of the injury, there will be ground for suspecting traumatic contraction or occlusion of the ureter.

It is, however, impossible to distinguish injured ureter with extravasation, from injured renal pelvis with extravasation; injured ureter with complete obstruction by clot or recurved ends is equally indistinguishable from injured kidney with clot plugging the renal pelvis or the ureter.

Some assistance may, perhaps, be obtained, where an opening in the ureter is believed to exist, by distending the bladder with water. Kammarer found that the water escaped by the defective ureter until the bladder was quite distended, and then, doubtless through closure of the valvular entrance in the bladder, the water ceased to flow. Le Fort and Page applied this test in their cases, but without effect.

Tuffier thinks that a constant escape of urine after a wound of the ureter is the leading distinction between these injuries and wounds of the kidney.

In cases of injury of the ureter not complicated with other serious injuries, the immediate effect of these accidents is not to endanger life, if the peritoneum is uninjured. If prompt and decided surgical treatment were adopted, the consequences to the kidney itself would be less unfavorable; and subsequent nephrectomy would probably be less frequently required than has been the case hitherto.



When the peritoneum is involved the outlook is most serious. Henry Morris (Edinburgh Med. Jour., Jan., '98).

**TREATMENT.**—The ideal treatment is immediate suture or anastomosis, but unfortunately the exact injury is not usually recognized until some time has elapsed and the peritoneum has become infected or a retroperitoneal cyst has formed. In case a cyst has formed, puncture may be tried, but the result is uncertain. Lumbar incision with evacuation of the extravasated fluid and drainage offer the most favorable conditions for repair. Wounds of the ureter usually heal ultimately without suture, although, if the injury be found, it should be repaired. Nephrectomy will be required if there is evidence of extensive suppuration, septic nephritis, or a permanent fistula that is a source of intolerable discomfort.

The ideal treatment for subcutaneous rupture, whether in a longitudinal or transverse direction, is immediate suture or anastomosis of the ureter. A free incision in the ilio-costal space will secure the complete evacuation of the extravasated fluid; and drainage will obviate the reaccumulation of urine subsequently escaping through the ruptured tube. If the ureter is completely torn asunder, and its ends can be approximated, they should be united by one of the recognized methods of ureteral anastomosis. If its ends cannot be joined together, then a permanent fistula, opening on the loin, is the result to be expected. Nephrectomy will be required, if pus in the extravasated fluid, continued high temperature, or recurring pyrexial attacks, with pain, loss of appetite, and emaciation, make it clear that the kidney or the retroperitoneal tissue is the seat of extensive suppuration. Nephrectomy may be demanded also in the absence of suppuration, if a permanent fistula has resulted and is a source of intolerable discomfort to the patient. Henry Morris (Edinburgh Med. Jour., Jan., '98).

In cases in which the ureter has been cut through, the proper treatment con-

sists in implantation of the proximal end of the ureter into the bladder. When this is not possible, owing to the high situation of the injury, the next resort is extirpation of the kidney on that side. R. Fütth (Centralb. f. Gyn., July 16, '98).

Unintentional division of the ureter in operations in the abdominal and pelvic cavities is apt to occur in cases in which numerous adhesions exist. Several methods of dealing with the condition are available. The kidney on the injured side may be removed; the ureter may be passed into the intestine, colon, or rectum; or into the vagina or through the abdominal wall; the kidney may be brought down, and the extremity of the ureter sutured into the wall of the bladder; an anastomosis may be made between the extremities of the divided ureter. This classification, while not exhaustive, covers the most important procedures so far devised. Of these methods the last two are the most worthy of consideration. Uretero-ureteral anastomosis would seem to be the operation of choice. Uretero-ureteral anastomosis, or uretero-ureteros-tomy, as the operation is designated by Kelly, may be performed in various ways. Henry Morris gives the following classifications: End-to-end anastomosis by suturing the ends together in a transverse line; end-to-end anastomosis; lateral implantation; end-to-end anastomosis by suturing the ends together in an oblique line. The transverse end-to-end method was used by Schopf (1886) in the first recorded cases of uretero-ureteral anastomosis. The objections to the operation were so serious that the operation has been almost discarded to-day. Poggi originated the end-to-end anastomosis. Lateral implantation was devised and described by Van Hook in 1893. Kelly was the first to apply this method to the human subject. The oblique end-to-end anastomosis was first used by Bovée. The author reports two successful cases in which the Van Hook method was resorted to. Johnson (Amer. Gynæc., Jan. 19, 1903).

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## URINARY SYSTEM, SURGICAL DISEASES OF (CONTINUED).

### Diseases of the Urethra.

**Anomalies of the Urethra.**—The roof of the urethra may be absent, *epispadias*; or the floor may be deficient, *hypospadias*. The condition of epispadia is associated with exstrophy of the bladder. These conditions are not infrequent, hypospadias, however, being the more common.

Congenital *narrowing* or *occlusion* of the urethra and entire absence of the canal are of such rare occurrence that their consideration is almost superfluous. Narrowing, or atresia, should be treated in the same manner as acquired strictures in the same situation. Occlusion is most often due to a thin membrane, which may be broken through with a bougie. If firmer and of greater extent, it may be divided by means of an appropriate knife, or by external incision, either with or without suprapubic cystotomy, and retrograde catheterism, according to the situation and extent of the obstruction.

**Injuries of the Urethra.**—Wounds of the urethra may be produced from without or within. Punctured wounds from without will probably require a permanent rubber catheter for some days and the ordinary treatment of the external wound. Full-sized urethral bougies should be passed at intervals subsequently to prevent undue contraction of the scar.

External lacerated wounds, involving the urethra, require a permanent catheter. The urethra should be united over this with fine catgut sutures if possible. The external wound should be allowed to heal by granulation usually. Exceptionally, clean wounds in favorable condition may be closed by primary suture. Careful suturing of the urethra

will do much to prevent the formation of a troublesome stricture. At the end of a week or ten days the catheter may be removed, after which a steel bougie of appropriate size should be introduced at regular intervals.

Injuries of the urethra produced from within, usually false passages caused by attempts at passing metal instruments in cases of stricture, require antiseptic irrigations of the urethra, and the internal administrations of urinary antiseptics.

### Rupture of the Urethra.

This occurs chiefly either behind an old tight stricture or from a fall in which the patient alights astride some sharp object, such as the edge of a board or a rail. Rupture of the urethra from fracture of the pubic bones, from "breaking" chordee, and from other forms of injury is of less frequent occurrence.

**Symptoms.**—The cases due to stricture must be considered separately from those due to the other causes mentioned. Usually a small, painful swelling will appear at some point along the course of the urethra. This may remain localized, forming an abscess, or it may give rise to a rapidly-spreading cellulitis, accompanied by the usual signs of inflammation. Urine will be passed with difficulty and in a very small stream or there may be complete retention. Upon inquiry it will be found that the stream of urine has been gradually diminishing in size, and that it has been passed with increasing difficulty.

Rupture of the urethra from alighting astride a sharp object or from fracture or even disjunction of the pubes takes place in the membranous portion. Those cases due to the irrational practice of breaking of the penis for the supposed cure of chordee and to other rare forms of trauma occur in the pendulous urethra.



Pain, hæmorrhage, and retention of urine are the common symptoms in these cases. Swelling and ecchymosis may or may not be present, depending at first upon the nature of the accident and later upon whether there is extravasation of urine or not. The pain is usually not severe. Bleeding from rupture in the pendulous urethra always appears at the meatus. That which takes place from injuries to the membranous urethra may also appear at the meatus or flow back into the bladder and give rise to hæmaturia. Retention of urine may be complete from the moment of the accident and dependent upon an extensive laceration, or after some hours, as a result of swelling and blood-clot. If the case is not seen early, and a permanent catheter introduced, extravasation of urine will probably occur at the point of the rupture, and with a rapidly-spreading cellulitis.

**Treatment.**—In examining a patient who has had an injury or condition which could give rise to rupture of the urethra, the parts should be inspected for any external evidences of injury. Inquiry should be made as to the appearance of blood at the meatus and whether urine has been voided. If there are signs of rupture of the urethra, an attempt should then be made to pass a soft-rubber catheter of medium size. Preparatory to this the glans and prepuce should be cleansed thoroughly. The catheter, having been boiled previously, should be connected with a fountain-syringe containing an antiseptic solution, then oiled in carbolized vaselin or other suitable lubricant, the solution permitted to pass for a moment, and finally it should be slowly introduced into the urethra with great gentleness, the fluid meanwhile being allowed to flow.

The urethra is thus thoroughly irrigated, the fluid escaping around the catheter. Among the antiseptic fluids appropriate for this purpose may be mentioned a solution of potassium permanganate, 1 part in 5000; bichloride of mercury, 1 part in 10,000; or carbolic acid, 1 part in 500; and boric-acid solution, 10 or 15 grains to the ounce of sterile water. If the catheter passes into the bladder easily, the urine should be withdrawn and the catheter removed. The patient should be thus catheterized about every six or eight hours. If the catheter passes with great difficulty and only after repeated efforts, it should be allowed to remain, being securely held by any appropriate means. If the catheter fails to pass the point of rupture, other sizes may be tried as well as other forms. The Nélaton catheter is a very useful form, the point being kept on the roof of the urethra, which in partial tears is less apt to be involved than is the floor. If a catheter enters the bladder it should be allowed to remain.

If no catheter whatever will pass into the bladder, a metal bougie or other firm instrument should be introduced until it is arrested. The point of the instrument should then be exposed by an incision in the middle line. The tip of the instrument will guide the operator to the distal end of the torn canal and the proximal end should then be sought for. When found, a soft-rubber catheter should be passed into the bladder from the meatus, and the divided urethra sutured with fine, chromicized catgut, if at all possible. In searching for the proximal end of the urethra very careful search should be made in the wound before much dissecting has been done, as this would tend to add to the difficulty of locating it. When the usual means fail, pressure above the pubes will

frequently cause a few drops of urine to exude and thus locate the urethra. The external wound should be united by sutures if the conditions will permit, drainage being introduced if necessary.

When a catheter is retained in the bladder it should be kept thoroughly clean by irrigating through and around it with boric-acid solution or other mild antiseptic. The catheter may be removed in from five to ten days, depending upon the extent of the injury. Subsequently steel sounds should be passed every second day, using great gentleness in their introduction, but gradually using larger sizes until the full calibre for the particular patient has been reached. After the wound has healed firmly the bougies must be continued, at first once a week; later, once a month; and with diminishing frequency for one or two years, to prevent, as far as possible, the formation of a stricture. In all cases this tendency continues throughout life, so that the occasional use of the bougie must be continued.

Five cases of rupture of urethra personally treated by external urethrotomy and suture. Conclusions: 1. In cases of ruptured urethra immediate perineal section with suture of the urethra should be practiced. 2. By this procedure not only is the danger of urinary infiltration and abscess greatly lessened, but in a large proportion of cases one may hope to prevent the formation of close intractable strictures. 3. In an early operation the search for the posterior end of the urethra is much easier than it is later. The hæmorrhage from the branches of the artery of the bulb serves as a guide to that end of the canal. Cabot (Boston Med. and Surg. Jour., July 16, '96).

During the early treatment of these cases, whether an operation has been performed or not, frequent examinations should be made of the region of the wound in order to detect the earliest evidences of infiltration of urine if this

should occur. This would indicate that the catheter was not efficiently draining the bladder. Extravasation, accompanied by swelling, pain, and heat, requires early and free incisions, frequent antiseptic irrigations, and dressings.

### Gonorrhœa.

A contagious, specific inflammation of the mucous membrane of the urethra or vagina, accompanied by a muco-purulent discharge. The disease may also be communicated to other mucous surfaces. Of these, the conjunctiva is most frequently affected (see CONJUNCTIVA, DISEASES OF), and occasionally the rectum is involved. True gonorrhœa is due to infection with the gonococcus, first described by Neisser. Inflammation of the urethra (urethritis) may, however, be established by other causes, probably by other micro-organisms under certain conditions. According to the definition given, these cases should not be considered as examples of gonorrhœa, but in practice it is common so to do, as the treatment is almost or quite identical. If any legal questions are apt to arise, it may be necessary to establish positively the nature of the disease.

Gonorrhœa usually results from sexual intercourse with a person suffering from the disease. It may be transmitted in exceedingly rare cases by means of contaminated towels, etc.

**Symptoms.**—The commonest example of gonorrhœa is that of the urethra in the male, and the remarks that follow will refer exclusively to this form. The disease usually begins to manifest itself within from three to five days after the infecting intercourse. The first symptom is an irritation of the meatus, which is found to be of a deeper-red color than normal, and from which a very slight watery discharge escapes. The urine passing over the affected area usually



causes considerable smarting. The inflammation, which began at the meatus, extends backward, and rapidly becomes more intense, so that in twenty-four to forty-eight hours the discharge has become profuse, thick, yellowish, and, in the severer cases, even tinged with blood. The pain experienced in urinating is very intense (*ardor urinæ*). The patient has obstinate erections, especially at night, which are accompanied by severe pain. This symptom, which is called "chordee," is rarely absent in some degree of intensity. In many cases the patient is obliged to urinate at very frequent intervals. This is especially true of the cases in which the inflammation invades the posterior urethra. The swelling of the mucous membrane and periurethral tissues may be so great that the stream of urine is very small.

The severity of each of these symptoms varies widely in different cases, depending largely, no doubt, upon the virulence of the infection. It is a matter of common observation, also, that the first attack of gonorrhœa is usually accompanied with more severe symptoms than subsequent attacks. In fact, a person who has once had gonorrhœa seems predisposed to urethral irritations or inflammation, doubtless induced by infectious or other causes so mild that a perfectly-healthy urethra would remain entirely unaffected. In this so-called subacute or catarrhal type the chief symptom is the discharge, which is more watery than in the acute severe form. There may or may not be slight irritation on passing urine.

Four hundred cases of gonorrhœa examined with a view to the relative frequency of the different complications. Each case examined per rectum. Of the cases, 160 were acute, 180 subacute, and 60 chronic.

Posterior urethra affected in 92.8 per

cent. Prostate, vesiculæ seminales, or prerectal vas deferens affected in 141 cases, or 35.25 per cent. (28 per cent. in acute cases, 40 per cent. in the subacute and chronic cases). Of these 141 cases, 88 had prostatitis, 5 vesiculitis, 46 both prostatitis and vesiculitis, and 2 both of these with pelvic vasitis in addition.

All the cases were free from symptoms of complications. Colombini (*Giorn. Ital. Mal. Vener. e Pelle.*, No. v, '96).

From a study of urethritis the following conclusions are reached: 1. Of 160 patients attacked with acute urethritis and examined by the author, 26 had anterior urethritis, 22 posterior urethritis, and 112 total urethritis. 2. Vesical tenesmus with frequent micturition was observed in 6 out of the 26 cases of anterior urethritis. 3. Out of the 22 cases of posterior urethritis vesical tenesmus with frequent micturition was observed 7 times, and in 10 cases there were frequent pollutions. 4. In total urethritis, even when complicated by prostatitis, gonecystitis, or epididymitis, vesical tenesmus was never observed, nor were pollutions or pains in the posterior urethra. In 13 out of the 112 cases of this group there was a little blood at the end of micturition. 5. The terminal hæmaturia would seem to indicate that the internal orifice of the bladder is profoundly affected by the inflammatory process which, in this case, occupies the fold of the vesico-urethral orifice. S. Rona (*Archiv f. Derm. u. Syph.*, p. 141, '98).

The following is a precise means of diagnosing posterior urethritis: The urethra is first washed with a 0.5- or 1-per-cent. boric-acid solution, then a  $\frac{1}{4}$ -per-cent.-pyoktanin solution is injected and retained for five minutes in the canal, and finally the urethra is again washed with the boric-acid solution until the washings pass colorless. The patient then urinates, and if the urinary filaments passed are found to be colored violet, it is an indication that they come from the anterior part of the urethra. If, on the contrary, they are colorless, they come from the posterior part. E. Lehrwald (*Sem. Méd.*, xviii, p. 18, '98).

Experiments with pure culture of the

gonococcus obtained from a gleet discharge of two years' standing gave following results: 1. Attempted reinfection of the original urethra with this culture always failed. 2. The culture, when transplanted to a coccus-free urethra, produced typical acute gonorrhœa. 3. Infection from this back again to the original urethra gave a fresh gonorrhœa, which, after a typical acute course of five or six weeks, again subsided to a chronic gleet. This most interesting experiment demonstrates that by passing an attenuated gonococcus through another individual—that is, through a fresh culture ground—it becomes again virulent to a urethra which was immune to it before. This explains how an apparently healthy man, if he have the gonococcus lurking anywhere in his urethral tract, may infect his hitherto uninfected wife, and how he may be again infected from her. H. Brooks Wells (N. Y. Polycl., May 15, '98).

The earliest diagnostic symptom of urethral contraction is the appearance of shreds in a clear, or semiclear, urine. At first these shreds are almost imperceptible, but their presence is quite constant from the time of submucous involvement, and as the canal becomes smaller the shreds increase in size. No case of gonorrhœa should be discharged as cured until the morning urine is clear of *débris*, and the patient should be kept under observation for at least six months, that urinal shreds may be detected early should they appear. J. Henry Dowd (Phila. Med. Jour., Mar. 11, '99).

In boys the period of incubation, the general characteristics, and the history of the disease are not different from those manifestations in the adult. The incubation from one to seven days, the pain and burning sensations, frequent desire to micturate, and other symptoms are as seen in the usual adult gonorrhœic. The discharge is usually profuse, but the pain seems out of proportion to the clinical picture presented. This hypersensitiveness is, however, coincident with contracted prepuce or meatus, which serve to dam back the secretions and, by preventing proper

drainage of the urethral canal, cause retention of inflammatory products.

Complications occur in young boys similar to those of adult patients, after the disease has lasted several days: posterior urethritis, prostatitis, and epididymitis, etc. A. L. Wolbarst (N. Y. Med. Jour., July 6, 1901).

There is also a small class of cases designated "non-specific" because of the absence of the gonococcus. The usual causes assigned are: contact with irritating vaginal secretions other than those of gonorrhœal origin, the introduction into the urethra of irritating liquids or foreign bodies causing inflammation, etc. The symptoms of these cases begin as do those of true gonorrhœa, but usually run a much shorter and milder course.

In many cases of chronic urethritis one is unable to demonstrate the presence of the gonococcus; these cases are probably non-infectious. In any case the possibility of infection as compared to an acute urethritis is small. A urethritis due to an attenuated organism, and consequently modified in intensity, may be contracted from a chronic urethritis.

Conversely: Several negative examinations of the secretion from a chronic urethritis do not prove its non-infectiousness. The infectiousness or non-infectiousness of a chronic urethritis can only be determined by frequent and careful examinations of the secretion, and if these prove negative, by the non-appearance of the gonococcus after the application of Neisser's test (an acute urethritis caused by saline nitrate injections). E. R. Owings (Johns Hopkins Hosp. Bull., Oct., '97).

The important diagnostic point for the gonococcus is its property of decolorizing by Gram's method. The other points of morphology and position inside the leucocytes are not necessarily characteristic. In the application of the method of cover-glass examination combined with Gram's method of staining for the identification of the gonococcus, the most important precau-



tion is to smear the pus properly on the cover-glass. Usually it is too thick. The best preparations are those obtained by scraping off the pus from the cover-glass as much as possible with a platinum loop or knife-point, after it has been placed thereon.

Another important precaution to be observed is to be sure that the aniline-oil-gentian-violet solution has not decomposed. This solution should not be used when it consists simply of a clear fluid and a brown sediment. To avoid errors in this regard the solution should not be more than two weeks old. Oscar Richardson (Boston Med. and Surg. Jour., Feb. 7, 1901).

**Abortive Treatment.** — In theory the abortive treatment of gonorrhœa is ideal. It is successful, however, in the very earliest manifestations of the disease only. In practice, unfortunately, patients are very rarely seen at this stage. After the gonococci have penetrated beneath the superficial layers of the urethral epithelium, and after the symptoms are well marked, this method should not be employed. In adopting this treatment the surgeon should be guided to some extent by the wishes of the patient, as well as by the local condition. There are cases in which it is imperative to cut the disease short. It should be explained to the patient that the abortive treatment will be followed by considerable inflammatory reaction, and that it may fail to arrest the disease.

Given, therefore, a patient who presents himself, within from one to three days after exposure, with a slight irritation at the meatus and a scant, watery discharge, the advantages and disadvantages of the abortive treatment should be fairly presented, and, if he so elects, the surgeon is justified in carrying out this method. The technique is as follows: The patient urinates, the anterior urethra is then washed out with sterile water or boric-acid solution, and a solu-

tion of silver nitrate, 20 grains to the ounce of distilled water, is applied to the first inch and a half or so of the urethra, either with a French pointed urethral syringe or a cotton swab introduced through an endoscope. The patient should then be treated as for the early stages of acute gonorrhœa. All the symptoms of acute anterior urethritis develop rapidly, and in successful cases, gradually subside and disappear in a few days. If unsuccessful the disease runs the usual course.

Instead of this single, powerful application, frequent, copious irrigations of the anterior urethra with potassium permanganate, 1 to 2000; corrosive sublimate, 1 to 5000; or silver nitrate, 1 to 1000, may be employed. By this method the patient is spared the discomforts caused by the more active treatment, but it is less likely to succeed.

A case of gonorrhœa seen within eight days from the outset can be aborted. For the first five days a 2- to 4-per-cent. protargol solution is used, and during five days following 1 to 2 per cent. Two injections of about 5 to 10 drops are given daily, and the solution is kept within the urethra for from ten to fifteen minutes each time. In 100 cases, gonococci were present at the commencement in every case. In 63 cases they were not found after the first day, in 15 not on the third day, and in 9 not at the end of 7 days. Ahlstrom (Hygeia, Dec., '99).

Abortive treatment based upon a study of thirty cases, most of which were cured in from eight to ten days. A specimen of the discharge is taken for microscopical examination; then the patient passes urine, after which the urethra is washed out with hot water twice a day, and a 10-per-cent. solution of argonin, freshly made, is introduced by an Ultzmann deep-injection syringe, or, better still, by a rubber bulb holding about six drachms. The solution is introduced hot, and is kept in the front urethra by pressing the lips of the meatus together as the point of the

bulb is withdrawn. An applicator is then tightly wrapped with absorbent cotton and dipped in a 10-per-cent. solution of argonin and introduced into the urethra as the argonin solution is allowed to flow out. The cotton swab is applied gently to all parts of the anterior urethra for two or three inches and then withdrawn. The operation is repeated, but the applicator is not used the second time if the patient complains of much pain. Follen Cabot, Jr. (Phila. Med. Jour., Jan. 26, 1901).

Decinormal salt solutions in gonorrhœa accidentally discovered to cause the discharge and other symptoms of the disease to cease at once. Since then the salt solution has been personally employed in all cases and very good results reached. The indication is simply to cleanse the urethra with a hot and non-irritating fluid as often as possible: *i.e.*, at least every hour, though intervals of two to three hours may be admissible. In 98 cases, the average time of cure was 12  $\frac{1}{2}$  days; about 30 per cent. lasts 7 days; 30 per cent., 11 days; 20 per cent., 17 days; 10 per cent., 20 days; and 10 per cent., over 3 weeks. The actual duration of the symptoms was less than this, however. C. E. Woodruff (Merck's Archives, July, 1901).

Some cases of gonorrhœa are capable of being treated in the very early stages by an abortive method. The indications for such a treatment are that the discharge must not have been present for longer than three days; that it is not already of a thick, purulent nature; and that the urethral mucous membrane is not tender when water is being passed. The cases which are especially suited are those in which the discharge is of a serous nature with only a trace of pus in it; when examined by the microscope, only a few gonococci are to be found, and these are principally placed extracellularly. At first, the writer carried the treatment out with solutions of silver nitrate, and although fairly good results were obtained with it, other preparations have since been found to be better adapted. A 2-per-cent. solution of  $\text{AgNO}_3$  was used, which

was allowed to remain in the urethra for from 20 to 30 seconds, after which the canal was washed out with water. On the following day a 2-per-cent. solution was used and this strength continued during the rest of the treatment. The stronger injections were but little painful, but on the next morning the patients usually complained of considerable pain. The preparations which have given better results are protargol, albargin, and another silver body, a combination of the metal and gelatose, which is not yet on the market. The protargol was used in a 4-per-cent. solution, and the albargin in 1- and 2-per-cent. solutions. Neither appeared to irritate the urethral mucosa at all, and it was left in the urethra as long as from three to five minutes, and the strength of the solutions was not lessened on the second day of treatment. This abortive treatment has been successful in curing 40 per cent. of personal cases, but the injections should not be discontinued as soon as the discharge has ceased; usually this occurs after the second day, but it will be found on careful examination that there are still some pus-cells in the urine, which disappear on the fourth or fifth day. The injections should be continued for a few days longer. In those cases in which the treatment proves of no avail, no harm is done by the attempt to shorten the attack. In recommending this procedure the author admits that he is not advocating anything new, but is merely suggesting a new adaptation of an old method. The progress of every case of gonorrhœa should be gauged by regular microscopical examinations of the discharge. A. Blaschke (Berliner klin. Wochen., May 12, 1902).

If either of these has been tried and has failed, the following routine treatment should be carried out:—

**Treatment.**—In the most severe cases with a high grade of inflammation, profuse discharge, ardor urinæ, and chordee, it is very desirable to have the patient go to bed, or at least to be as quiet as possible. A light diet should be ordered,



consisting largely of milk, with bread, potatoes, well-boiled rice, and such plain farinaceous foods. Water should be drunk freely. The bowels should be kept rather free with small doses of some saline laxative, repeated as often as necessary to secure the desired result. The use of alcohol should be forbidden. Sexual excitement is harmful, and coitus is to be positively forbidden, both on account of the contagious nature of the discharge and the injurious effect on the disease. The urethral discharge should be received on a small piece of absorbent cotton held in place by a gonorrhœa apron, or similar device, and the glans and prepuce bathed frequently with soap and warm water for the purpose of cleanliness and also to avoid balanoposthitis. The most rigid caution must be observed in disposing of the soiled cotton, towels, and all other articles contaminated with the discharge, and the hands should be most carefully washed after each dressing, as gonorrhœal pus, if transferred to the eye in any manner, excites a most violent inflammation which requires the most constant and active treatment for weeks and may even result in the loss of the eye.

Gonorrhœa is a local disease, and must be treated largely locally. Internal remedies are of use, however: (1) to render the urine neutral or faintly alkaline, and hence less irritating; (2) to increase the flow of urine; and (3) to allay irritation of the urinary tract by such drugs as are sedative to mucous membranes and are excreted by the urine. Liquor potassæ meets the first indication. It may be given in doses of 10 minims, freely diluted in water four to six times a day. Potassium citrate fills both the first and second indications. The dose is 20 grains in half a glass of water every two to four hours. With either of these

may be combined sweet spirit of nitre if there is fever, and potassium bromide to lessen the excitability of the nervous system. The third indication for internal treatment cannot well be met when the urethritis is very acute, as cubebs, copaiba, and sandal-wood seem to exert a more favorable influence on the sub-acute and chronic cases. When the severity of the inflammatory symptoms has passed off, however, one of these may be administered with advantage. A combination which has been very satisfactory in a large number of cases is the "compound-salol capsule" originated by Dr. White a few years ago. Each capsule contains: salol, 5 grains; oleoresin of cubebs, 5 grains; Para balsam of copaiba, 10 grains; and pepsin, 1 grain. Four to 6 of these are to be given daily after meals. Capsules of either the cubebs or copaiba or the two in combination may be given and in the more chronic stages the oil of sandal-wood, 10 to 20 minims after each meal, is efficient.

Nine cases of acute gonorrhœa in the male have been treated by the internal administration of methylene-blue. All cases were first attacks. Two cases were seen four and five weeks, respectively, after the discharge had ceased, and no recurrence had then taken place. In one of these cases the discharge ceased in twelve days and in the other in sixteen days. The methylene-blue is excreted unchanged in the urine. The dose given was 3 grains three times a day. J. Moore (Brit. Med. Jour., p. 140, '97).

Methylene-blue administered internally will cure gonorrhœa in from four to seven days. To the diplococcus, which is the specific cause of this disease, it is especially fatal. The pyogenic bacteria that make gonorrhœa a mixed infection succumb very promptly to this germicide.

It is best given in gelatin capsules in 1-grain doses three or four times a day. After the fourth day the dose may be reduced to twice a day. Given alone it sometimes causes irritation of the neck

of the bladder, but when combined with oil of nutmeg there is no trouble of this kind. J. Alan O'Neill (Med. Record, Mar. 24, 1900).

Locally cleanliness secured by frequent bathing and suitable means to receive the discharge are very desirable. Rubber covers and bulky dressings that retain the secretions and macerate the parts are objectionable. If urination is accompanied by severe pain, great relief will be secured by immersing the penis in a vessel of water as hot as can be borne comfortably during the act of passing the water.

Urethral injections or irrigations may be employed from the beginning of the disease. Certain points must be kept in mind in this connection:—

1. Nothing is to be introduced into the urethra until it has been cleansed by passing urine.
2. The solutions used in the early stages must be exceedingly mild unless abortive treatment is attempted.
3. In the beginning the injection is confined to the first inch or two of the urethra. In high grades of inflammation the solutions should be slightly alkaline, and if used as warm as can be borne will give greater relief. It may be stated positively that any application that causes severe or prolonged pain or smarting is harmful, as the resistance of the tissues is thus lessened and further extension of the infection is favored in consequence. In an acute case the injection may be of potassium permanganate, 1-10,000 to 1-5000 in normal salt solution, as in the following formula:—

R Potassii permangan.,  $\frac{1}{2}$  to 1 grain.  
Sodii chloridi,  $\frac{1}{2}$  drachm.  
Aquæ destillatæ, 11 fluidounces.

M. Sig.: Use four to six times daily, as directed.

A similar solution is also employed to

“irrigate” the urethra. To a pint of distilled water may be added from  $\frac{3}{4}$  to  $1\frac{1}{2}$  grains of potassium permanganate and 45 grains of sodium chloride, the solution warmed, and placed in a fountain-syringe to which a urethral nozzle is attached by rubber tubing. The reservoir should be two feet above the pubes. Urine having first been passed, the solution is allowed to run, and the nozzle fixed firmly in the meatus. As soon as the anterior urethra is distended the nozzle should be removed and the urethra allowed to empty itself. This is repeated until the pint of solution is all used.

Irrigations with permanganate of potassium are as efficient as those with argonin and protargol, and possess the merit of being extremely cheap. Niebergall (Deut. Milit. Zeits., No. 6, '98).

Protargol, the new silver proteid compound, has been personally given a careful trial in 40 cases of acute gonorrhœa, most of them being seen during the first week of the infection, and none of them having been previously subjected to other treatment. From these cases it is decided that protargol is a very efficient anti-gonorrhœal remedy, which, if employed at an early period, exerts prompt and favorable influence upon the course of the disease, in the majority of cases, arresting all acute manifestations, causing rapid disappearance of the secretion and gonococci, preventing extension of the process to the posterior urethra, and usually giving good results even in fully developed cases of anterior and posterior urethritis. The injection of protargol ( $\frac{1}{4}$  of 1 per cent. to 1 per cent.) should be kept up for a number of weeks, after which astringents should be resorted to in order to prevent recurrence. E. Finger (Times and Register, June 11, '98).

In acute gonorrhœa a smear of the discharge is made, if possible, on a cover-glass in order to confirm the diagnosis. This having been established, a 1-per-cent. solution of protargol is prescribed which is to be used slightly warm, in a  $\frac{1}{4}$ -ounce blunt-pointed rub-



ber syringe, three or four times daily. The patient is directed to urinate before the injection, and then to grasp the glans penis and raise it perpendicularly, putting it slightly on the stretch, but not to put a finger on the perineum to prevent the fluid from going back into the bladder. The fluid should be retained in the urethra five minutes, the patient gently stripping it backward with the finger while holding the meatus closed. Any slight smarting complained of by the patient will appear only during the first two or three injections, and then only temporarily.

The patient should also be told to drink alkaline mineral waters, as Vichy, Seltzer, plain soda, etc., and to take an abundance of water between meals, but to drink only one cup of coffee daily. He should avoid alcohol, and be moderate with tobacco; also abstain strictly from coitus and avoid severe exercise. F. B. Newton (Texas Courier-Rec. of Med., Oct., 1900).

Solutions of the silver salts, organic or inorganic, do not penetrate the mucosa to any great extent. The prolonged pressure of any fluid upon the urethral mucosa causes temporary compression of the capillaries; their removal of this pressure is followed by dilatation of these capillaries, resulting in an increased leucocytosis through the walls of the vessels; the point of least resistance is the lumen of the urethra; this induces more rapid exfoliation of mucous membrane cells, and literally carries out the infectious agent. It is upon the free gonococci thus forced into the surface layer of the mucous membrane that the silver salts exercise this bactericidal action. W. L. Baum (Medical News, Oct. 15, 1904).

To subdue a very high grade of inflammation the following will be found useful:—

℞ Ext. opii aquosi, 16 grains.  
Vel morph. sulph., 2 grains.  
Liq. plumbi subacetat. dilut., 6 fluidounces.

M. Sig.: Use warm, if possible, four to six times daily.

The pain experienced upon passing urine is most efficiently treated by rendering the urine slightly alkaline and by diluting it by drinking water very freely. Painful erections or chordee may be so persistent and painful as to demand treatment.

For the relief of this condition the patient should be instructed to empty the bladder just before retiring for the night, and to be awakened by an alarm clock at the end of three or four hours for the same purpose. He should sleep upon a hard mattress, with but a light covering over him, and he should avoid lying upon the back.

Of the drugs that are useful, the bromides may be given in full doses, and in the more severe cases chloral or opium may be necessary. A suppository containing opium, belladonna, and monobromated camphor may be administered at bed-time when necessary, but should be employed only for severe pain. If a painful erection occurs, the patient should arise and apply cold locally, although in rare instances heat gives greater relief. Cold applications to the spine are also efficient in some cases.

Such is the routine treatment during the first few days in the cases presenting very acute inflammatory symptoms. When these subside, or, from the beginning of the cases of the subacute type, the injections may be made somewhat stronger, like the following:—

℞ Potass. permang.,  $\frac{1}{2}$  to 1 grain.  
Boric acid, 1 to  $1\frac{1}{2}$  drachms.  
Aquæ dest., 6 fluidounces.

M. Sig.: Use as an injection four times a day after urination.

An injection like the following is useful in a large proportion of cases at this stage:—

R̄ Hydrarg. chlor. corros.,  $\frac{1}{12}$  to  $\frac{1}{6}$  grain.

Zinci sulphocarb., 24 to 30 grains.

Ac. carbol., 10 to 12 grains.

Boroglyceride, 2 fluidrachms.

Aq., q. s. ad 6 fluidounces. (White.)

This is to be used in the same manner as the previous prescription. It may be diluted at first if its use causes pain. During this period one of the capsules already alluded to should be given.

As the amount of discharge diminishes, the injections may be made stronger and more astringent. Any of the following may be employed. Sulphate of zinc, acetate of lead, or alum, 1 to 5 grains to the ounce of water; glycerite of tannic acid, 10 to 30 minims to the ounce; and fluid hydrastis, 5 to 10 minims to the ounce, using the milder strength first, and gradually increasing the proportion. Various combinations of these drugs may be made with advantage in many cases. When the discharge becomes very scant and watery the treatment may be less active, the injections being made less frequently, although the strength may be cautiously increased. The average duration of a case of gonorrhœa is about six weeks. In some instances it is much less than this, while in others the period is much longer. The last trace of the disease to disappear is a drop of discharge or an undue moisture, observed at the meatus on rising in the morning. When this has been absent for some time, the cure may be considered complete. Shreds of epithelium may, however, continue to be present in the urine for some time.

One-and-one-half-per-cent. solution of argonin used, injecting  $2\frac{1}{2}$  drachms, to be retained for five minutes. Of 12 cases observed, in 9 the gonococci permanently disappeared in from 2 to 6 days. The secretion persisting after the discontinuance of the drug can be relieved by the

use of zinc sulphocarbolate and other remedies. Lewin (Berl. klin. Woch., Feb. 17, '96).

Most satisfaction in treating gonorrhœa obtained by use of permanganate of zinc. Permanent cure noted in 50 cases treated by this drug. It is equally successfully in both acute and chronic cases. After the stage of acute inflammation has subsided injections are made four or five times a day after urination, with an ordinary blunt-pointed hard-rubber syringe with a capacity of three to four drachms. Beginning with a solution of  $\frac{1}{2}$  grain to the ounce of water, one gradually increases to three times that strength. H. S. Hotaling (Med. News., Nov. 7, '96).

The treatment by argentamin can be commenced at any stage of the disease, and usually insures a complete cure within a fortnight, no presence of gonococci in the discharge after this time being discernible. In urethritis daily injections of 1 in 2000 solution should be given. At first, after the injections, a slight increase of discharge is noted, but afterward this gradually and rapidly disappears. In vaginitis the daily local application of 1 in 1000 solution has been found most efficacious; while, in gonorrhœal endometritis, swabbing the uterine cavity with a 5-per-cent. solution is to be recommended. Gordon (Med. Record, Nov., '96).

Argonin used in 15 cases of gonorrhœa. The gonococci disappeared from the discharge in 9 days, on the average, without any noticeable symptoms of irritation being caused by the injections. After the germs had disappeared treatment with other astringents was continued for 21 days in order to complete the cure. A. Gattheil (Deut. med. Woch., No. 35, '96).

Results of treatment of gonorrhœa with argonin in 158 cases observed, the usual strength of the solution being 3 per cent. The writer infers that: (1) gonococci disappear from the urine in about three weeks under this treatment; (2) solutions varying in strength from 3 to  $7\frac{1}{2}$  per cent. cause no irritation; (3) the cure in cases of acute, hæmorrhagic cystitis is prompt. Baltz (Monat. für



prakt. Derm.; Centralb. f. Gyn., No. 21, '97).

The following treatment recommended for chronic gonorrhœal urethritis: A solution containing alum, sulphate of zinc, and carbolic acid— $\frac{1}{2}$  drachm of each to 6 ounces of distilled water—is applied by means of an Ultzmann syringe and soft catheter, first to the posterior urethra beyond the compressor-urethræ muscle, afterward to the anterior urethra in front of the compressor muscle. On the first day the strength of the above solution is  $\frac{1}{2}$  ounce to  $7\frac{1}{2}$  ounces of distilled water; on the second day, 6 drachms to  $7\frac{1}{2}$  ounces; on the third day, 12 drachms to  $7\frac{1}{2}$  ounces; on the fourth day, 12 drachms to  $4\frac{1}{2}$  ounces. After this the discharge usually ceases, and nothing remains but a few shreds and turbid urine. Then weak solutions of silver nitrate are applied in the same way, starting with 1 in 12,000, gradually increased in strength to 1 in 6000 on the fourth day. This is followed by passage of a sterilized sound into the bladder and allowed to remain there five minutes, after which 1 in 5000 silver-nitrate solution is again applied. This manœuvre is repeated every four days till the shreds are free from gonococci and pus. In cases where a morning drop of pus persists after the above treatment this is due to follicular involvement, which is treated by the application of 10- to 15-per-cent. silver solution, the follicles involved being found by the endoscope. If several large shreds persist after repeated use of full-sized sounds, there are probably granular spots which must be treated in the same way with silver nitrate. Injections are not recommended in the early stage of profuse discharge. Attention is called to lubrication of catheters and sounds with glycerin in place of oil, the latter preventing the solution used from coming into contact with the mucous membrane. Dowd (Buffalo Med. Jour., Aug., '97).

If gonococci are found in a discharge, the use of protargol should be commenced at once, and the injections should be used three times a day. At two of these applications the fluid should be retained for five minutes, while at the third the time

may be prolonged to thirty minutes. After a few days one injection of protargol daily will suffice, while at the other two occasions some astringent may be substituted. As the treatment is painless, it can be continued for three or four weeks if necessary. The strength of the solution should at first be  $\frac{1}{4}$  per cent., but it may soon be increased to  $\frac{1}{2}$ , and ultimately to 1 per cent.; excellent results have been obtained in cases of urethritis in women by solutions of from 5 to 10 per cent. Protargol is the best, the safest, and the quickest remedy employed in the treatment of gonorrhœa. Neisser (Centralb. f. Derm., Oct., '97).

Protargol is better than any other silver preparation, used as a 1-per-cent. solution for the anterior urethra, and  $\frac{1}{2}$  to 1 per cent. for the posterior urethra. Goldberg (N. Y. Med. Jour., Jan. 22, '98).

Largin is a gray powder produced by the action of an ammoniacal solution of oxide of silver on an alcoholic solution of the dry product of decomposition of the paranucleoproteids. In a solution of 1 in 4000 kills the gonococci. Kornfeld (Wiener med. Presse, Aug. 14, '98).

The following conclusions have been reached in regard to largin in gonorrhœa: (1) largin as an antigonorrhœic is at least equivalent to the other silver compounds; (2) it surpasses the other silver albumin compounds with regard to the power of killing the gonococci; (3) it penetrates more deeply with dead organic substances. Treatment should begin early to prevent immigration of the gonococci into the deeper parts of the mucous membrane. It may be injected in 1- to  $1\frac{1}{2}$ -per-cent. solutions several times a day and retained in the urethra for from ten to thirty minutes. Pezzold (Wiener klin. Woch., No. 11, '98).

The prolonged use of hot-water irrigations is advised in both acute and chronic gonorrhœa. A soft catheter is passed to within one inch of the prostatic urethra. It is then connected with a "gravity apparatus," in which the water is gradually heated up to the tolerance-point. The stream flows through the catheter and then back between catheter and mucous membrane, thus flushing out the anterior urethra. Several quarts of warm water

are thus passed, some patients having a tolerance-point as high as 180°-190° F. C. S. Murrell (*Mass. Med. Jour.*, vol. xviii, 289-292, '98).

In brief, the principles of the treatment for posterior urethritis are:—

1. Irrigations with the Janet method in a recent case of gonorrhœa will in many cases prevent posterior urethritis.

2. Irrigations with the recurrent catheter with permanganate of potassium, followed by injections of protargol, will cure in a relatively short time a case of subacute posterior urethritis without complications.

3. When chronic posterior urethritis lasting for a long time has caused infiltration of the submucous tissues, then the application of a sound with ichthyol salve gives the desired results. A. Ravogli (*Internat. Jour. Surg.*, Mar., '99).

A new preparation of argonin is called Argonin-L. The new argonin is easily soluble in cold water and can be kept in solution for several months without decomposing. Also it contains 10 per cent. of silver instead of 4.2 per cent. A 1-per-cent. solution is personally used for cases of both anterior and posterior urethritis. Cases of anterior urethritis were treated by injections thrice daily and retained for five minutes. Posterior urethritis was treated by instillation with Ultzmann's syringe. After disappearance of the gonococci, astringent injections of zinc sulphate were used, but the patients had also three injections weekly of the argonin. Frequent examinations of the urine were made and the absence of gonococci and threads demonstrated. Other patients were treated with the old argonin and results showed the superiority of the new argonin. Jellink (*Wiener med. Woch.*, No. 5, '99).

The results, in the 53 cases of gonorrhœa treated by argonin injections, show that argonin is by far the best thing in the treatment, and if used with judgment will achieve really remarkable results. If a case is seen within forty-eight hours after the appearance of the discharge, argonin alone is a very satisfactory treatment, and in a majority of uncomplicated cases will effect a rapid and absolute cure in from four to fifteen

days. In one case seen the day the discharge appeared, and in which the gonococcus was found, argonin injections alone caused the discharge to disappear on the fifth day. In this case a 2-per-cent. solution was used in 15-cubic-centimetre syringe and retained ten minutes, four times a day.

In cases where the urinary symptoms were severe the patient was given the alkaline treatment internally and the injections of argonin for the urethral injections. A 2-per-cent. solution has been the most satisfactory strength, although as high as 5 per cent. may be used in severe cases with excellent results.

In vulvo-vaginitis permanganate irrigations were very satisfactory, but they were slower than the argonin. The strengths used were 5 per cent. and 10 per cent. for from three to five days, followed by reduction of degrees to 2 per cent.

Much depends on the preparation of the solution. If possible, the surgeon should prepare it personally, and it should be dispensed in dark bottles. The most satisfactory method of preparing the solution is to first make a paste of the necessary amount of argonin powder, using hot water. To this paste enough hot water is added to make the percentage solution required. This solution should be strained. Another very good method is to shake 1 part of argonin in 10 parts of cold water; add sufficient boiling water to make the desired quantity and shake until the argonin is in solution. Then this is strained. W. W. Wilson (*Buffalo Med. Jour.*, Jan., 1901).

Study of 236 cases of gonorrhœa treated in the course of one year, using solutions of protargol,  $\frac{1}{2}$  per cent. in strength for the first 2 weeks, increasing gradually if the secretion persisted. Ninety-nine of these cases had their first attack, and from these he deduces his statistics. The time required to obtain a cure ranged from 5 to 43 days. In 34 of these cases there were complications. Comparing his series of 670 cases treated during 1896, the average duration of the attack was no better



with protargol than with other methods of treatment. Its only advantage is that it is somewhat less painful. Nissen (*Münchener med. Wochen.*, Mar. 19, 1901).

The writer has used silver vitellin (protargol) in the local treatment of gonorrhœa. It is absolutely free from any irritating properties, solutions as high as 5 per cent. causing no discomfort. The gonococci on and beneath the urethral mucous membrane are rapidly destroyed. The amount of urethral discharge is at once lessened in a marked degree in the majority of cases. The actual duration of the disease is shorter than is obtained by the use of any other silver salt. In the writer's series of cases 38 were cured in from two to four weeks. H. M. Christian (*Medical Record*, Sept. 27, 1902).

After the patient appears to be well, his habits should be guarded for a few weeks, as the discharge may recur again from sexual excess, overindulgence in alcohol, etc. In some instances of the disease in the subsiding stage the discharge seems to be kept up by excessive treatment. This should be borne in mind, and guarded against. Cases that persist for two or three months usually exhibit localized areas of infection in some of the urethral follicles or pouches, superficial ulcerations, or even beginning stricture formations, and call for a careful urethral exploration.

The question as to what the physician shall say to a gonorrhœal patient who wishes to marry may be summarized as follows:—

If the presence of Neisser's gonococci is demonstrated, the physician's duty is clear. But, if the bacteriological examination is negative, his answer should cover the following points:—

As a negative bacteriological examination is not an absolute proof of the absence of gonococci, it is the patient's first duty to make an earnest and sustained effort to rid himself of the gonorrhœa or chronic inflammation of the urethra by a systematic course of specific treatment.

This is not to be neglected even in cases where the examination has for a long time repeatedly failed to detect gonococci.

If a complete cure is found impossible, or if the patient refuses to subject himself to further treatment, the physician should explain the case under its various aspects, and leave the decision with the patient. In no case is the physician to assume the responsibility of the gonorrhœa not becoming infectious.

If the patient decides to marry, the physician should impress upon him the fact that he is still capable of giving the infection, and must, therefore, observe the following rules in sexual intercourse:—

1. Urinate immediately before sexual congress to expel any secretion that may have accumulated in the urethra.

2. Avoid as much as possible having intercourse oftener than once a day.

3. Never perform the act twice in succession, because, if the first seminal discharge contains gonococci, the friction attending the second coitus brings them into closer contact with the urethra and cervix, thereby increasing the danger of infection.

If this rule is disregarded, and the act is performed more than once in twenty-four hours, the vagina should be thoroughly flushed out with a vaginal douche, which should, in general, be employed as often as possible. Kromayer (*Münch. med. Woch.*, No. 24, '98).

A previously cured case of gonorrhœa gives a certain amount of immunity to a patient. The older the man, the less his liability to gonorrhœa. After the age of thirty a man who has had gonorrhœa may in many cases safely have sexual connection with women who would be certain to communicate it to younger men and to men whose urethras have not been rendered to some degree immune by previous gonorrhœa. I. N. Bloom (*Amer. Pract. and News*, Sept. 15, '98).

### Gonorrhœa in Women.

The gonorrhœal process in women affects, in the order of frequency, the urethra, the cervix uteri, the vulva, and the vagina. While in adult life the vagina is the seat of the disease but

rarely, before puberty an infection with gonococci is most apt to cause an inflammation of this canal. This is to be explained by the resistance offered by the vaginal mucosa of the adult to this micro-organism. The diagnosis in any case is established if gonococci can be demonstrated in the discharge. Their absence, especially in the chronic forms of the disease, does not, of necessity, exclude the specific origin of the disease. In cases of true gonorrhœa the patient must be warned against infecting the eyes.

Gonorrhœa after the more acute and evident symptoms have passed off, and its contagious properties have been obliterated, leaves in its train a series of characteristic signs on the organs it has implicated, which are designated "the residual signs of gonorrhœal infection." (a) On the vulva it may be noted in the form of red spots around the openings of the glands of Bartholin, around the para-urethral ducts, or on the summits of the carunculæ vulvæ. (b) As adenitis glandulæ of Bartholin is described the hard nodular, though painless, condition of these glands are felt when the region of the gland is squeezed between the finger and thumb. (c) As shallow circumscribed ulcers at the mouths of the Bartholinian ducts, the result of rupture of a previous abscess. (d) As the great majority of cysts of the gland of Bartholin. Sânger (*Ann. de Gynéc.*, May, '97).

On 310 women who had been married for at least a year without becoming pregnant, 72 had been married ten years or over, the others three years, on an average. Of 50 of these women's husbands, 38 had had gonorrhœa and 34 had infected their wives. According to this ratio, in the whole number of husbands there must have been 235 who had had gonorrhœa, and 210 who had infected their wives: an inference that is supported by the fact that in 198 of the women the same inflammatory lesions were found as in the 34 who were known to have contracted the disease from their

husbands. Vedelar (*Norsk Mag. f. Lægevid.*; *Hot Springs Med. Jour.*, July, '98).

Demonstration of the gonococcus is the only reliable method of diagnosing gonorrhœa in prostitutes. Many cases of undoubted gonorrhœa would escape recognition if clinical evidences alone were relied upon. Several examinations should be made if the gonococcus is not found at first. Neisser (*Berl. klin. Woch.*, No. 10, '98).

In the diagnosis of chronic gonorrhœa in the female the symptoms upon which the most reliance can be placed is chronic urethritis. There are other symptoms of chronic gonorrhœa, which, though not of themselves pathognomonic, may become so if associated with disease of the uterus and adnexa. Among these may be included condylomata, signs of inflammation of the glands of Bartholin, the maculæ gonorrhœica of Sânger, tissue-defects and scars in the vulva, vaginitis maculosa and granulosa. As a rule, the joint appearance of endometritis and inflammatory diseases of the adnexa bespeaks gonorrhœa. Dependence cannot be placed upon a microscopical examination of the secretion; while the finding of the gonococci is of positive diagnostic value, failure to do so is not proof against the existence of gonorrhœa. P. Broese and H. Schiller (*Berl. klin. Woch.*, July 18, '98).

Where large numbers of other organisms are present and gonococci are relatively few in number, the methylene-blue cannot be depended upon at all, and Gram's method is not satisfactory. In just such cases, the following, which is Pick-Jacobsohn's stain, if properly used, will show the organism, if present, beautifully differentiated. It is made and used as follows:—

R. Ziehl's carbol-fuchsin, 15 drops.

Concentrated alcoholic solution of methyl-blue, 8 drops.

Distilled water, 20 cubic centimetres.

The specimen is to be stained cold for 10 seconds, washed with water, dried, and mounted. The gonococcus will be stained a deep blue, other bacteria a light blue,



cell-nuclei a still lighter blue, and protoplasm pink. R. G. Schnee (Bull. Cleveland Gen. Hosp., Apr., '99).

A study of gonorrhœal ulcerative endocarditis, with cultivation of the gonococcus, shows that (1) gonococcal urethritis may be the starting-point for a fatal septicæmia induced by a pure infection with the gonococcus; (2) endocarditis and arthritis are occasionally complications of such an infectious disease; (3) the endocardial processes may be incited by the gonococcus without the association of other organisms. A. J. Lartigau (Amer. Jour. Med. Sci., Jan., 1901).

While formerly gonorrhœa was presumed to be a simple disease, it is now known to be very serious. The gonococcus has been found capable of affecting all the serous membranes. Some of the Germans go so far as to say that 80 per cent. of gynæcological affections are due to the gonococcus. Most of the children who lose their sight shortly after birth do so because of gonorrhœal ophthalmia. This disease still continues to furnish a large contingent to blind asylums, and 10 to 20 per cent. of all the blind owe their affliction to gonorrhœal infection. Formerly the number of such cases was even larger, running as high as 40 to 60 per cent. At the present moment there are in Germany, according to Neisser, 30,000 patients who are blind because of the gonococcus. Gonorrhœa has more to do with failure of the population to increase than syphilis. At least 20 per cent. of sterile marriages are due to gonorrhœal processes either in the husband or wife, and 90 per cent. of the cases of azoöspemia that occur owe their origin to gonorrhœal affections of the epididymis. Prince A. Morrow (Med. News, Mar. 23, 1901).

The curative treatment of gonorrhœa in women consists of rest, thorough cleansing by douches containing some antiseptic solution, and local applications. If the vagina or vulva be affected, it should be douched every three or four hours with 1 to 5000 bichloride solution or  $\frac{1}{4}$ -per-cent. lysol solution. Local application of 1-per-cent. nitrate

of silver or 2-per-cent. protargol should be made to the urethra once every twenty-four hours. The solutions applied to the vulva, vagina, and cervix should be stronger. For this purpose tincture of iodine or 5-per-cent. nitrate of silver may be employed. These applications should be made once a day for three or four days and then every second day until all evidences of inflammation have disappeared. If the cervix is enlarged and congested it should be depleted by local blood-letting once a day for two or three days. Should an abscess form in the vulvo-vaginal glands it should be opened and treated in the usual way. J. B. Killebrew (Medical News, Jan. 25, 1902).

URETHRA.—In the period of incubation, the changes in the external meatus, and the appearance of the discharge, gonorrhœa of the urethra in women is identical with that observed in men. There is frequent urination, attended with a scalding sensation, and the discharge may irritate the parts contiguous to the meatus, adding to the suffering. The bladder is apt to become affected, owing to the very short urethra, in which case the frequency of urination and tenesmus may be extreme.

In severe cases much benefit will be obtained by putting the patient at absolute rest. Frequent external bathing of the parts with water as hot as can be borne, to which a little bicarbonate of soda or borax has been added, will help to allay the inflammation and insure cleanliness. Internally, some form of potash—the citrate or bicarbonate or even the liquor potassæ—is indicated to give a faint alkaline reaction to the urine, which should be tested frequently and the dose of the drug regulated according to the effect. Water should be partaken of freely. The urethra should be irrigated by some form of reflux catheter, or by Nélaton catheter of small size, which will permit the fluid to flow

back around the instrument. The formulæ given under the treatment of gonorrhœa on p. 633 are to be employed, and the patient should invariably urinate before the irrigation to cleanse the canal of discharge. The strength of the solution should be very weak in the beginning of the treatment, but should be increased as the acuteness of the symptoms subsides.

**VULVA.**—Gonorrhœa of the vulva may be a primary affection and may exist without the involvement of the other parts, it may transmit the disease to either the urethra or vagina, or it may have been complicated by infection of one of these canals from the beginning. It is rarely met with in adult life, but is seen more frequently in young girls, who become infected either during an attempt at coitus or by mediate contagion.

The symptoms appear in one or two days after infection. The vulva is swelled, red, and hot, and a free discharge issues from between the labia majora. Upon separating these, the labia minora are seen to be much swelled and covered with pus. There may also be superficial erosions. The patient experiences severe burning pain in the parts, and the urine, in passing over the inflamed area, causes very acute suffering.

In the treatment rest and cleanliness are the first essentials. Frequent and thorough bathing of the entire inflamed surface with water, as warm as can be tolerated, comfortably, to which has been added some bicarbonate of soda, or borax, will give great relief. Warm solution of potassium permanganate, 1 to 5 grains to a pint, is also useful. Pieces of absorbent lint or cotton wet with a mixture of 1 or 2 drachms of the aqueous extract of opium to  $\frac{1}{2}$  pint of dilute

lead-water may then be applied to the inflamed surfaces. The vagina should be irrigated through a soft-rubber catheter with one of the above lotions. Solution of silver nitrate, 10 to 30 grains to an ounce of distilled water, applied once or twice daily, after the cleansing, has a very beneficial effect on the inflamed mucous membranes. As the condition improves, more astringent lotions may be substituted. Chlorate of potash, alum, and zinc sulphate are all useful. If an abscess of Bartholin's gland develops, it must be opened freely and the cavity packed with gauze.

**VAGINA.**—Gonorrhœa of the vagina is rare in adults, and when present usually affects young girls. It may exist with a similar affection of the urethra, the vulva, or both. The chief symptom is a profuse purulent discharge. It is to be treated on the lines already laid down. Sometimes, after cleansing, tampons of boroglyceride in combination with mild antiseptics or astringents are very useful. For inspection as well as for local applications the knee-chest position gives a much better exposure than any other, and is to be recommended.

**CERVIX.**—Gonorrhœa of the cervix uteri is the most serious form of the disease, inasmuch as it may extend upward, involving the uterus, the Fallopian tubes, the ovaries, and may give rise to peritonitis. Nor is the danger over when the acute symptoms have subsided. The disease may remain latent in the cervix for a long time, ready to assume a fresh virulence and to spread to other structures under favorable conditions.

The symptoms are variable and by no means characteristic. The mucous membrane is applied so firmly to the uterus with no loose submucous tissue intervening that it does not respond to gonorrhœal infection in the same man-



ner as does that of the other regions mentioned. There is but a moderate amount of discharge, thus contrasting strikingly with the other forms mentioned, and might easily escape notice, especially with those who had had a previous leucorrhœa. In the more severe cases there may be a feeling of fullness or weight in the pelvis, which is increased by exercise. Menstruation is apt to be more frequent and more profuse than normal, and may be unusually painful. If the cervix be examined, it will be found to be swelled and of a deeper red than normal, with the os somewhat everted, or pouting. A tenacious secretion of muco-pus will be seen issuing from the os and bathing the adjacent parts. The mucous membrane around the os may have exfoliated, leaving an eroded or ulcerated surface. Such conditions may exist for an indefinite period.

In the treatment of these cases it is usually recommended to cleanse the cervix and os carefully; swab with bichloride-of-mercury solution, 1 to 2000; and then apply silver-nitrate solution, 10 per cent.; zinc-chloride solution, 10 per cent.; copper-sulphate solution, 10 per cent.; or Lugol's solution. A more radical and more efficient treatment is the dilatation and curetting of the cervix after the preliminary cleansing. Such active measures should be undertaken only by those specially equipped by large experience. The danger of a consecutive gonorrhœal metritis, salpingitis, and peritonitis demands that this disease receive the most intelligent treatment. The latter conditions belong rather to the gynæcologist than to the genito-urinary specialist.

Chronic latent gonorrhœa in the male may set up the same disease in a woman without any acute symptoms either in

the vulvar region or higher up in the genital tract. The urinary passages often escape entirely. The vagina itself may escape infection, the endometrium alone being attacked. Pregnancy goes on unimpeded, but in the puerperium slight fever is observed and gonococci are found in the discharge. The best injection in these cases is a 1 in 2000 solution of nitrate of silver. Fritsch (*Centralb. f. Gyn.*, No. 31, '97).

Results of treatment in 140 successful cases reported. Solutions of nitrate of silver from 1-1000 to 1-3000 were poured into the vagina through a cylindrical speculum, the cervical canal being swabbed out with the same. In cases of gonorrhœal endometritis the uterine cavity was irrigated with the same solution. Mihajlovits (*Amer. Jour. Med. Sci.*, Jan., '98).

Protargol found to be the safest and best application in the treatment of gonorrhœa in women, in cases in which the cervical canal, the endometrium, and occasionally the tubes are involved. The author's method is as follows: (1) the vulva and vagina are cleaned and disinfected; (2) the cervix is gently pulled down, and when necessary the internal os enlarged with dilators; (3) the uterus is washed out with sterile tepid water; (4) then with at least 3½ pints of a ½-per-cent.-protargol solution; next, if this produces no irritation, with (5) a 1-per-cent. solution; (6) the vagina is dried with sterile cotton-wool, and a 5-per-cent.-protargol bougie passed into the cervical canal, and kept in place with a tampon; (7) after fifteen minutes, when the bougie will have melted, the tampon is removed, the vagina dried with wool, and a 10-per-cent.-protargol-glycerin tampon introduced; (8) after twenty-four hours the same process is repeated, and every day for five to seven days, only the protargol solution is strengthened gradually to 2½ per cent., and the bougies to 10 per cent. The woman should keep in bed for the first week of treatment; (9) although at the end of this time no gonococci can be found, it is necessary to repeat the process every other day during the second week; on the alternate

days astringent solution ( $2\frac{1}{2}$ -per-cent. bismuth subnitrate with glycerin and water) and bougies of boro-phenol-alum 1 per cent. are used, though the tampon is still of protargol glycerin; (10) during the third week astringents alone are employed (a daily injection of the bismuth with one alum bougie and tampons of glycerin of tannin); (11) cure is completed in three weeks, but it is well for the woman to continue the injections herself for a time. Fürst (Ther. Monats., Apr., '98).

Local treatment should always be instituted, consisting of irrigation of the urethra with protargol  $\frac{1}{2}$ -per-cent. solution increased to 1 per cent. This is preferably accomplished by Skene's reflux catheter or a soft-rubber catheter. At the same time internally a capsule containing balsam of copaiba and oil of sandal-wood is administered. When the urethritis persists and tends to become chronic, astringent applications of zinc and alum are repeatedly made to the urethral tract. The diagnosis of cervical gonorrhœa can only be made by the microscope, as the clinical symptoms are not pronounced. The best treatment consists in the injection into the cervical canal of solutions of 1- and 2-per-cent. protargol. The syringe used for this purpose resembles the deep urethral syringe of the male, but has no curve. The treatments should be made every other day at the least. Small (Univ. of Penna. Medical Bulletin, July, 1902).

### Stricture of the Urethra.

The urethra, except during the passage of urine, of semen, or of an instrument, is in a collapsed condition. Under normal conditions it is dilatable to a certain calibre, depending upon the circumference of the flaccid penis. Any condition which interferes with this normal dilatability is called a stricture. The common causes that give rise to symptoms of stricture are: 1. Inflammatory changes such as accompany acute urethritis. This condition is temporary and subsides under appropriate treat-

ment. 2. Muscular spasm, usually of the compressor urethræ, and due to the irritation caused by an acute urethritis or an erosion of the urethra either alone or existing behind a stricture, or more rarely to reflex irritation from hæmorrhoids, anal fissure, etc. 3. The organization and contraction of lymph following gonorrhœa or other form of injury to the urethra. The latter is called "organic," or "true," stricture. Congenital stricture of the urethra is so rare as to be a curiosity. The diagnosis and treatment are, however, similar to organic stricture.

**Symptoms.**—The symptoms commonly observed by the patient are: a gleet discharge; some increased frequency of urination; dribbling at the conclusion of the act, which is apt to require a longer time than normal and may require some voluntary effort; the stream may be much smaller in calibre than normal; and may be forked, twisted, or otherwise altered. If one or more of these phenomena be present in a man who has had gonorrhœa, or other serious urethral lesion, stricture may reasonably be looked for. The actual presence of this condition is determined by exploration of the urethra. For this purpose the acorn-headed bougie (*bougie à boule*) should be employed.

It has been found as a result of a large number of observations that the following approximate relationship exists between the circumference of the flaccid penis at the middle of the pendulous portion and the calibre of the urethra:—

CIRCUMFERENCE OF PENIS.	CALIBRE OF URETHRA.
3 inches.	26-28 millimetres.
$3\frac{1}{4}$ inches.	28-30 millimetres.
$3\frac{1}{2}$ inches.	30-32 millimetres.
$3\frac{3}{4}$ inches.	32-34 millimetres.
4 inches.	34-36 millimetres.

(White.)



A suitable lubricant for urethral instruments is liquid vaselin or liquid alcoholene containing 2 per cent. of carbolic acid, or 25-per-cent. solution of boroglyceride containing the same amount of carbolic acid.

If a *bougie à boule* of appropriate size can be passed into the bladder and withdrawn without being arrested at any point, the calibre of the urethra must be considered normal. If a stricture is present the instrument will be arrested at the contracted area if it is distinctly smaller than the bulb of the bougie, or, if the calibre is very nearly the same as the circumference of the acorn-head, the stricture may not be detected until the instrument is withdrawn, the abrupt shoulder being especially designed to detect contractions, when passing in this direction. It is well to begin the examination of a case with an instrument at least nearly equal to the normal calibre of the urethra as determined by the above table, and if it meets an obstruction beyond which it will not pass to try smaller and smaller sizes until one be found that will enter the bladder. Strictures will be met with so small that nothing larger than a filiform bougie will pass, and occasionally even this cannot be introduced.

In urethral instrumentation, whether for diagnosis or treatment, the greatest gentleness should be used. Force is never justifiable.

**Etiology.**—Nothing need be added under this head to what has been said of the first two varieties of stricture. Organic stricture is usually the sequel of gonorrhœa. The gonococci tend to penetrate the mucous membrane and to develop in its deeper layers, thus establishing also a periurethritis. Further, the severity of the inflammation at one or more points causes exfoliation of the

epithelium, so that there is a tendency for the urine to infiltrate the tissues. To prevent this nature surrounds the vulnerable point with a deposit of lymph which organizes into firm, unyielding scar-tissue, and gradually contracts, interfering with the dilatability of the urethra. The contraction is very slow; so that months and perhaps years may pass before the patient is aware of any distinct trouble in urination.

The next most frequent cause of stricture is rupture of the urethra. This usually occurs in the membranous portion from alighting astride of some sharp object or from fractures of the pelvic bones. The resulting changes are very similar to those observed in strictures of inflammatory origin. The reparative material thrown out around the rupture is far in excess of the actual needs, and when this organizes it contracts and encroaches upon the urethra.

**Treatment.**—Strictures are treated by (1) dilatation or (2) cutting [(a) internal urethrotomy; (b) external urethrotomy]. The various other methods described are applicable to so few cases or are to be entirely condemned that they will not be mentioned here. For description of these the reader is referred to special works on this subject. It must be understood that all of the following procedures are to be carried out with the most rigid antiseptic detail.

**DILATATION.**—The method to be chosen in every case in which it is applicable is dilatation. It is unsuitable in: 1. Impassable strictures. 2. Those below 10 or 12 of the French scale, as it is unsafe to pass bougies below this size. 3. Strictures of the meatus and first inch and a half of the urethra, as experience has demonstrated that these will not yield to dilatation. 4. Strictures of the pendulous urethra, usually. If of

recent formation and of large calibre, gradual dilatation should be tried. 5. Traumatic strictures, as a rule, are not dilatable and require division.

Dilatation may be either continuous or gradual. Continuous dilatation is suitable only in strictures below 10 or 12 French. In order to prepare for gradual dilatation in these cases a whalebone filiform should be introduced, and, if possible, two or more, and retained from twenty-four to forty-eight hours. The effect will be to soften and enlarge the calibre of the stricture. Or, having passed a filiform into the bladder, a Gouley tunneled catheter may be introduced over this as a guide and retained. As soon as either of these methods has secured sufficient enlargement, gradual dilatation should be commenced. This form of treatment will usually be applied to strictures situated in the bulbous or membranous urethra, excepting those of traumatic origin.

Gradual dilatation is advised in all cases of stricture of the deep urethra if a No. 12 French or larger instrument can be passed. It should also be tried in recent soft, large strictures of the pendulous urethra, excepting those of the first inch and a half of the urethra. This method is carried out as follows: Suppose a No. 16 French *bougie à boule* has demonstrated a stricture, a No. 17 or 18 metal urethral bougie should be passed and allowed to remain a few moments, after which a 19 or 20 may be introduced. The next treatment should be three to five days later, depending upon the case, at which time probably an 18, 20, and 22 bougie may be passed, and so on, increasing one or two sizes at each visit, until the normal calibre of the patient shall have been reached. Occasionally a stricture will be so dense and inelastic that the same sizes must be

used at two or more successive *séances* before a larger size will pass. In carrying out this procedure the general rule should be to "coax" the stricture rather than to employ force. After the full calibre of the urethra has been obtained a bougie of the proper size should be passed at gradually increasing intervals for two to three years, and, if any tendency to recontract is observed, throughout the patient's life.

The less force is used, the more certain are the results in the dilatation of stricture. The general rule should be to pass two soft bougies, differing by one-third of a millimetre, or two to four metallic bougies, differing by one-sixth of a millimetre, at a time; to leave them in but a minute or two, or even to withdraw them at once; to pass them not oftener than upon alternate days, and always to begin with a lower number. Thus, and thus only, will one successfully treat a dilatable stricture—that is to say, the great majority of strictures. If one has in hand a "bad" stricture, one may try "prolonged dilatation," but only with soft bougies that enter easily—with, indeed, a bougie that seems "too small."

Clinical experience shows that it is the dynamical, not the mechanical, use of dilating instruments that will give lastingly-good results, without inconvenience and without danger to the patients.

If all the resources of this method are fairly tried without achieving sufficient dilatation, there is but one resource—internal urethrotomy in one form or another. A. A. Warden (*Glasgow Med. Jour.*, Sept., '97).

In all cases of old stricture the treatment must be conducted in carefully-regulated stages, and the urine submitted to frequent examination. In some cases, in which the introduction of any instrument has been attended with very considerable difficulty, a capillary catheter has been successfully used.

The capillary catheter must always be handled with great delicacy and patience. After injecting the urethra with warm oil, the penis is drawn forward with the left hand, and the instrument gently



passed down to the stricture. As soon as its progress is arrested it must be withdrawn two or three inches, rotated between the thumb and finger, and again twisted down upon the obstruction. During the repetition of these manipulations it often slips into the bladder, at the same time its free and easy movement in the urethra, together with the sensations experienced by the patient, clearly indicate to the operator that the stricture has been overcome.

The instrument is generally retained in position for about thirty-six hours. When the operation of dilatation after prolonged rest and many patient efforts proves unsuccessful, and the patient remains exposed to the risk of complications, the operation of external urethrotomy, followed by bladder drainage through the perineum, is recommended as the very best surgical procedure that can be practiced. J. W. Cousins (Brit. Med. Jour., Jan. 8, '98).

In every case of urethral stricture the surgeon should first try gradual dilatation before recommending a cutting operation. The results are quite as permanent and the duration of treatment (from 3 to 12 months) is actually no longer than had urethrotomy been performed. S. T. Howland (Med. News, Apr. 9, '98).

A special method of rapid dilatation is recommended in the treatment of certain cases of advanced urethral stricture, especially those complicated by some degree of retention of urine and calling for surgical aid. The instrument employed is constructed on the lines of a Holt dilator, and is provided with a pilot-guide, as well as with a screw-top, in case the former proves useless. It contains a fine test-catheter on which the dilators run, and is fed with a series of 7 rods by which dilatation can be carried from a No. 3 to a No. 12 (English scale). The dilatation is effected under anæsthesia, and must be done deliberately, so as to stretch and not to lacerate the stricture, the operation usually lasting about from 10 to 20 minutes. When the stricture has been fully dilated the instrument is quietly withdrawn, and the urine that remains is evacuated with a

full-sized silver catheter. Reginald Harrison (Lancet, Aug. 6, '98).

Notwithstanding the unfavorable results in a few cases, electrolysis is a valuable method in the treatment of the glandular form of chronic urethritis. From a study of 17 cases, the following conclusions are reached:—

1. In all cases of suspected urethral disease (excluding cases of acute urethritis) a careful urethroscopical examination should precede treatment.

2. As a rule, all forms of chronic urethritis can be cured by regular dilatations and urethral injections of a silver-nitrate solution.

3. Electrolysis is indicated only in the glandular form of chronic urethritis.

4. Electrolysis will cure the larger proportion of chronic glandular urethritis.

5. If electrolysis fails, the dilatation treatment is indicated.

6. In some cases of chronic urethritis, dilatation treatment preceding electrolysis will prove beneficial.

7. In those cases in which firm and dense cicatrices have developed in consequence of electrolysis, regular dilatations should be proceeded with.

8. During treatment endoscopical examinations of the urethra should be regularly made, controlling thereby, under the direct guidance of the eye, the progress of the disease, and, according to the conditions found, modifying the treatment. G. T. Mundorf (Med. Record, Aug. 20, '98).

After four years' experience of electrolysis in urethral stricture, its results considered superior to those obtained from internal urethrotomy. Chassaignac (New Orleans Med. and Surg. Jour., May, 1900).

**URETHROTOMY.**—Gradual dilatation having failed, or being impossible, some form of cutting operation will be necessary.

*Internal Urethrotomy.*—Strictures of the meatus and first inch and a half of the urethra may be divided either by a convex, blunt-pointed tenotome or by one of the various forms of urethrotomes. Strictures situated from an inch

and a half to four or four and a half inches from the meatus may be divided by a urethrotome, the dilating instrument being the best for this purpose. If the calibre is below 15 French, it may be necessary to employ a urethrotome of the Maisonneuve variety to prepare for the dilating urethrotome. The division should be made in the floor of the urethra. After having cut the stricture a *bougie à boule* of appropriate size should be passed to be sure that the proper calibre has been obtained, and, if not, a second division should be made.

A soft-rubber catheter should be passed and retained for from three days to a week. After its removal, full-sized metal bougies should be passed as directed under gradual dilatation, and continued at less frequent intervals for some years.

A urethra which is about to be incised should be made sterile, if this is possible, and the urine of such a patient should always be sterilized at least twenty-four hours before the operation, and should be kept sterile during the time of treatment. The administration of 20 drops of a mixture of 1 drachm of salol and 2 drachms of oil of gaultheria, three or four times a day, will sterilize the urine within twenty-four hours. In addition to this the urethra should be irrigated with permanganate of potash (1 to 3000) for five minutes before the operation, or it should be thoroughly "ballooned" with this antiseptic solution by using the ordinary conical syringe introduced at the meatus, and the canal thoroughly distended with the fluid. This should be repeated three or four times, and a sufficient pressure employed to overcome the resistance of the cut-off muscle, in this way reaching the entire canal.

The vast majority of all strictures of the urethra can be treated practically without pain with cocaine anæsthesia.

The susceptibility of every new patient to this agent should be carefully studied.

When the entire urethra is injected, 1 drachm of a 2-per-cent. solution should

first be employed, and the degree or the susceptibility of the patient, as well as the anæsthetic effect produced, can be ascertained in five or ten minutes. If the anæsthesia is incomplete and the patient shows no susceptibility to the drug, another drachm of the same or a stronger solution may be injected.

Anæsthesia of the membranous portion of the urethra may be obtained by carrying the Keyes-Ultzmann syringe-point down to the cut-off muscle, pushing it slightly within, and injecting 10 to 15 minims of a 4-per-cent. solution. Anæsthesia beyond the cut-off muscle is practically impossible. J. A. Wyeth (*New England Med. Monthly*, Jan., '97).

In the treatment of deep urethral strictures by internal urethrotomy, personal method is as follows: The urine is rendered antiseptic by giving 5 grains of salol and 5 grains of boric acid, three or four times daily, beginning several days before the operation, if possible. An anæsthetic having been given, the penis is washed with weak bichloride solution (1 to 2000) and the urethra injected with boric solution followed by iodoform and glycerin, 10 per cent. A filiform bougie is then introduced, and over it a Gouley tunneled staff. This being withdrawn, a Maisonneuve or Teevan urethrotome is inserted and the stricture cut on the roof of the urethra. A Teevan, which cuts to about a No. 26 French, is used. On its withdrawal Nos. 26, 28, and 30 sounds are passed. A new English catheter, about No. 26, is introduced and the bladder and urethra are syringed out with a boric-acid or very weak bichloride solution, and the catheter tied in. Sometimes a couple of drachms of iodoform and glycerin are injected, part of which flows away. After the operation the boric acid and salol are continued three times daily, or 3 grains of methylene-blue are given in capsules three times daily. The catheter is allowed to remain in the urethra until the third day, and sounds passed on alternate days thereafter. The patient is allowed to get up on the fifth to the seventh day, and is usually ready to leave the hospital to attend at the dispensary on the ninth. G. Davis (*Univ. Med. Mag.*, Aug., '98).



Conclusions based upon the results obtained in 1500 internal urethrotomies: In cases of chronic urethral discharge, internal urethrotomy should be practiced after all other methods of treatment have failed, and even when the urethra will admit a 26 French or possibly a 30 French, the cutting operation often effects a cure. The operation is followed only in very few cases by any untoward symptoms; occasionally slight dribbling of urine may continue, but never any worse than that caused by the stricture for the relief of which the operation was instituted. Among a few other sequels may be mentioned continuance of urethral discharge, pseudo-impotency, permanent chordee (this last very rare); sometimes hæmorrhage following either immediately or shortly after the operation gives considerable annoyance to the surgeon. Fatal results have been personally had from internal urethrotomy and the large majority of patients are permanently cured. G. Frank Lydston (Med. News, Mar. 4, '99).

The meatus must be cut to a caliber 2 millimeters larger than that of its normal urethra previous to properly carrying out any form of treatment. Internal urethrotomy yields the most permanent results of any method, and for strictures of the anterior urethra, irrespective of their character, is the operation of choice. All resilient, intractable, nondilatable, and impassable strictures of the bulbo-membranous or membranous urethra are best treated by external perineal urethrotomy. With the exception of these, all strictures so situated are best treated by gradual dilatation, unless, during its course, constitutional disturbances of importance arise, in which case it is safer to divide them at once by an external perineal urethrotomy. Divulsion and electrolysis are not methods to be commended. F. S. Watson (Boston Medical & Surgical Journal, Dec. 8, 1904).

*External Urethrotomy.*—This is usually required at the deep urethra, in which situation it is called external perineal urethrotomy. It is required for strictures of the bulbo-membranous and

membranous urethra that cannot be cured by gradual dilatation.

A staff is passed into the bladder, the urethra exposed by an incision in the middle line of the perineum and the stricture divided upon the staff. If the staff will not pass the obstruction the urethra should be opened on the tip of the instrument just anterior to the stricture. By carefully holding the divided edges of the urethra apart a filiform may be passed which will act as a guide in dividing the contracted portion.

In the operative treatment of urethral stricture, König includes in the technic of external urethrotomy the excision of all cicatricial tissue. At times as much as 3 or 4 centimetres have been excised. If possible the divided ends of the urethra should be united with fine catgut or silk sutures; not in its entire circumference, however, the floor of the urethra being allowed to remain patulous. In König's experience in cases in which it is impossible to approximate the cut urethral surfaces the interspace is eventually filled in by regeneration of tissue analogous to that in the urethra. This has been found to take place despite the fact that the urine is evacuated through the fistula. The precaution is taken, after each urination, to carefully cleanse the parts. At the expiration of three weeks the fistula is usually closed. Reinhardt (Phila. Med. Jour., Oct. 15, '98).

Attention is called to certain points in performing external urethrotomies for strictures which may prevent recurrences and annoying complications. The roof of the urethral canal should always be divided as well as the floor. In order to ascertain whether all of the stricture-tissue has been divided, the index finger, with the palmar surface directed upward, should be passed into the perineal wound and down to healthy urethra, well in front of the stricture, and then backward on the roof of the canal into the bladder. The posterior urethra should be dilated with the index finger, a measure which prevents post-operative tenesmus. Drainage is best attained by a large perineal

tube, which is withdrawn in two to four days to be cleansed and then replaced; it should be removed permanently on the fifth to seventh day. Post-operative dilatation should be begun as early as the second day. J. R. Hayden (*Amer. Jour. Med. Sci.*, Feb., '99).

External urethrotomy is applicable in resilient and rapidly contractile strictures in the deep urethra; in cases in which the wound made by an internal urethrotome is out of proportion to the natural drainage possibilities of the urethra; in stricture complicated with urinary fistulæ and sinuses; in cases of stricture with extravasation; in some rare cases of stricture in which operative treatment is rapidly followed by acute symptoms of impending death. Importance is attached to the use of a guide, the utility of the internal operation as immediately preliminary to the external, and the more efficient provision for urine and wound drainage. R. Harrison (*Lancet*, Mar. 17, 1900).

The after-treatment is the same as that given for perineal section.

**PERINEAL SECTION.**—Cases of impassable stricture of the deep urethra require perineal section. An instrument should be passed as far as possible, and the urethra opened upon its tip, through a median perineal incision. The strictured portion should then be divided, being careful to keep in the line of the urethra. A good light is essential, and the operation should be undertaken only by those who have had considerable experience in this line of work.

After all of these operations a pure-rubber catheter should be passed through the urethra into the bladder and retained for several days. The perineal wound is to be packed gently with gauze. After the catheter is removed urethral bougies should be passed as directed after internal urethrotomy.

#### **Diseases of the Prostate.**

**ANOMALIES OF THE PROSTATE.**—These are among the rarest examples of

defective development; they occur only in conjunction with extensive malformations of the adjacent urinary and genital organs.

#### **Wounds of the Prostate.**

**Symptoms.**—These will depend upon the nature of the injury. Wounds of the prostate complicating injuries to the perineum or rectum will be accompanied by the usual symptoms attending lacerated wounds in general. If the urethra is lacerated also, there will probably be retention of urine or extravasation at the point of injury; or retention may result from swelling of the gland, simply, without injury of the urethra. Infection of the wound will give rise to a diffuse inflammation, or, what is more serious, to phlebitis of the prostatic plexus, which is very prone to cause septicæmia or pyæmia. The extravasation of urine is apt to involve either the perineum or the prevesical space; in the latter case, if not checked by prompt incision and drainage, the extravasation will involve the areolar tissue of the abdomen, thighs, penis, and scrotum.

Wounds of the prostate caused by the unskillful use of catheters will be followed by hæmorrhage, probably by retention, and in some instances by inflammation of the gland.

The constitutional symptoms will depend upon the nature of the local condition. Profuse hæmorrhage will cause a blanched skin, pallid lips, subnormal temperature, and a rapid, thready pulse. Inflammation will be accompanied by severe local pain, frequently throbbing in character; fever, and acceleration of the pulse. Infection of the wound will have superadded to the symptoms of inflammation a higher and more irregular type of fever, and possibly chills. Infectious phlebitis is very apt to be accompanied



by chills and pronounced constitutional symptoms.

**Etiology.**—Wounds of the prostate are of rare occurrence, by reason of the protected situation of the gland. Lacerated wounds of the perineum or rectum caused by the individual being impaled on some pointed object may also involve the prostate. It may be injured in rare cases of extensive fracture of the pelvic bones. The prostate is wounded in puncturing the bladder with a trocar from the perineum, and it may be in carrying out the same procedure through the rectum; and, when enlarged, it has been wounded by injudicious attempts to pass a metal instrument through the urethra into the bladder. It is always cut in performing perineal cystotomy.

**Treatment.**—The first requisite is rest. The patient should be confined to bed. Wounds of the perineum involving the prostate require the same treatment as is appropriate for lacerated wounds elsewhere. Foreign bodies should be removed, bleeding vessels ligated, the surfaces cleansed as thoroughly as possible, and drainage provided for. Frequently no ligatures will be required, inasmuch as the use of a tampon of iodoform gauze will serve the double purpose of arresting the bleeding and securing drainage. If the wound of the prostate be extensive, it is advisable to introduce a catheter into the bladder through the urethra and to retain it, inasmuch as the subsequent inflammatory swelling may cause retention and the introduction of the catheter at this time would be both more difficult and more painful. If the urethra or neck of the bladder has been opened by the accident, it is particularly important to employ the retained catheter. If it is impossible to introduce the catheter on account of laceration of

the urethra, a perineal section should be made for the purpose of introducing the catheter. It may then be placed through the perineal wound, or, preferably, through the entire urethra. If bleeding has occurred backward into the bladder, copious irrigations of warm, boric-acid solution through the bladder should be employed. If the catheter becomes occluded by clots, they may be dislodged by making suction with the syringe or by injecting a little of the boric-acid solution.

Wounds of the prostate caused by fracture of the pelvis must be treated upon general principles in addition to the measures required for the other complications. If the urethra be lacerated a permanent catheter must be introduced, cutting down, if necessary, upon the point of laceration in order to pass the catheter into the bladder. The treatment of rupture of the bladder will be described under diseases of this viscus. Injuries of the prostate resulting from forced catheterization, if slight, recover spontaneously; if more severe, they require the use of the permanent catheter to provide against retention from swelling; and the use of urinary antiseptics and copious draughts of water, perhaps also the administration of mild sedatives.

Wounds caused in performing perineal cystotomy do not require any special attention.

In the care of wounds of the prostate from external causes frequent irrigations with antiseptic solutions and particular attention to all of the antiseptic details are desirable in order to limit as much as possible the extent of the inflammatory reaction. Careful attention to these details may frequently spare the patient the dangers accompanying septic inflammation of the prostatic plexus of veins.

All injuries of the urethra or bladder require the internal administration of urinary antiseptics.

### Foreign Bodies in the Prostate.

**SYMPTOMS.**—Pain and tenderness in the perineum and a frequent or almost constant desire to urinate, the act being accompanied by severe pain, are the prominent symptoms. By rectal examination the gland will be found somewhat swelled, unduly tense, and tender to the touch. Softening or fluctuation would indicate the formation of an abscess.

**ETIOLOGY.**—Vesical calculi, when of small size, may lodge in the prostatic urethra. Occasionally during the introduction of an old catheter a portion will break off at the point and remain behind. Cases are also sometimes met with in which foreign bodies in the prostate have been introduced into the urethra, and, having passed beyond reach, have lodged in the prostate.

**TREATMENT.**—In some instances these bodies may be removed through the urethra by the urethral forceps. This is particularly the case of the small calculi that become impacted here. Bodies that cannot be thus removed should be taken out through a median incision. If supuration should supervene, the abscess should be treated according to the general principles applying to treatment of abscesses elsewhere.

### Acute Prostatitis.

This occurs in two forms: the follicular and the parenchymatous. The former is much more frequently met with than the latter.

**Symptoms.**—These vary greatly in degree, probably owing to the nature and virulence of the infection. In the mildest form of the follicular variety there is a sense of heat and fullness in the perineum, with some increased frequency of

urination, which is attended with more or less pain. In the more marked cases the same symptoms exist in a much exaggerated degree; the fullness is replaced by severe pain, urination may be very frequent and painful and accompanied with considerable tenesmus, or there may be complete retention. On account of the sensitiveness of the gland, sitting may give rise to considerable pain, and digital examination of the prostate through the rectum will show that the organ is probably larger than normal and distinctly more tender to pressure.

The parenchymatous form, in which all of the structures of the prostate are involved, is accompanied by more severe symptoms than the follicular variety. The pain is more marked, and frequently of a throbbing character. The frequent urination and tenesmus are greater, or more probably there will be retention from the extent of the swelling. In the follicular variety there is usually a moderate degree of fever with a corresponding acceleration of the pulse. The parenchymatous form is apt to cause a higher temperature and is accompanied by marked constitutional symptoms, not infrequently with chills.

The usual history is that, following a urethritis, the train of symptoms above mentioned develop more or less suddenly. This should always excite suspicion of a prostatic complication. It is to be distinguished from acute cystitis, in which the frequent and painful urinations are more pronounced, while the complaints connected with the perineum and rectum are proportionately less. Inflammation of Cowper's glands gives rise to symptoms confined solely to the perineum. There will be no symptoms referable to the prostate. In all cases the digital examination of the prostate



will be the final test by which to determine whether it be inflamed or not.

**Etiology.**—In the vast majority of cases inflammation of the prostate is due to infection from a posterior urethritis. A number of other factors are mentioned as giving rise to prostatitis. Traumatism is probably one of the rarest of these. Exposure to conditions which cause internal congestions which are usually described as a “cold” is a more common cause. Occasionally the presence of a calculus in the prostatic urethra or other form of foreign body will excite inflammation. The excessive use of cantharides will in some instances have the same effect, as may also the use of irritating injections or of strong chemicals in the deep urethra. All of these conditions probably act by establishing a favorable soil for the reception and development of micro-organisms. Evidence is lacking to show that horseback-riding and bicycle-riding are productive of injurious effects if proper saddles be selected.

Acute prostatitis occasionally develops in the course of the infectious fevers, and it has been noted in a number of instances of pyæmia. Almost all of the cases met with, however, are due to infection from the gonococcus either alone or in combination with other micro-organisms.

**Treatment.**—The first requisite is rest. The patient should be confined to bed. The diet should be liquid and chiefly milk. Water may be given freely. In the more severe cases it is desirable to have the bed so arranged that the patient's hips shall be on a higher level than the shoulders. If the inflammation is of a high grade, considerable relief will be afforded by the application of a number of leeches to the perineum and around the margin of the anus.

Sitz-baths at a temperature of 100° to 105° and frequently repeated give relief by drawing the blood to the surface of the body. If there is marked vesical irritation great relief will be afforded by administering a mixture containing boric acid, sodium bromide, and tincture of belladonna. If there is much fever, a diaphoretic mixture containing potassium citrate, sweet spirit of nitre, and aconite will be very useful. If the pain is excessive, a small quantity of morphine may be added to the latter prescription. If this fails to relieve the pains sufficiently, suppositories of morphine or opium may be given in addition. If there is retention, the urine should be drawn at regular intervals with a soft-rubber catheter. If the inflammation has gone on to suppuration, it is desirable to evacuate the abscess as soon as softening or fluctuation is detected by rectal examination. The abscess should be opened in the middle line of the perineum and the urethra and rectum carefully avoided. In the case of small, circumscribed abscesses their presence will probably not be detected, and they usually evacuate themselves by spontaneous rupture into the urethra.

#### **Chronic Prostatitis.**

**Symptoms.**—The most prominent symptom is the occasional discharge of a clear, viscid fluid: the secretion from the glands of the prostate. It varies in amount from a few drops to half a teaspoonful. Occasionally the discharge is accompanied by spasm of the perineal muscles. It may be observed at intervals throughout the day, but it is especially noted during or after an action of the bowels, especially if the movement be constipated. In addition to this, the patient will have at least some of the following symptoms: Frequency of urination, dull pains in the perineum and

loins, a tickling sensation in the urethra, pain at the end of urination, some perineal tenderness which may make sitting uncomfortable, and moderately-increased sensitiveness of the prostate on rectal examination. There is usually some enlargement of the gland. The introduction of a catheter may reveal hypersensitiveness of the prostatic urethra. The urine usually shows some cloudiness, especially the first portion, which is due to shreds of muco-purulent matter and masses of epithelium from the prostatic urethra. Those suffering from chronic prostatitis very constantly exhibit an extreme degree of anxiety and mental depression. The various symptoms are magnified by the patient, who believes himself the subject of some serious malady. This is particularly true of the discharge, which is erroneously supposed by the laity to be semen.

Chronic prostatitis may be the cause of many serious consequences as sexual neurasthenia, sterility, impotence, and reinfections, it being a favorable nidus for lingering gonorrhœa. The symptoms until recent years have been placed under the headings, spermatorrhœa, azoöspermatorrhœa, prostatorrhœa, etc., and were claimed to be of neurotic origin. The literature, except within the last few years, has been both inadequate and misleading, because the pathology was unknown. Before giving consent for a patient with an apparently cured gonorrhœa to marry, the secretions of the prostate and appendages should be examined. There is no disease in which more information can be obtained from a careful examination of the prostate and secretions. A discharge after urination, defecation, or physical exertions; sexual disorders, no matter how mild; urine passed frequently with slight pain at the end of the act, should always lead to an examination of the prostate.

Treatment must be directed to complications as well as to the establishment of proper hygiene for the patient;

the prostate should be treated by massage, and heat or cold variously applied. The brilliant results of prostatic surgery should stimulate increased interest in the rational medical treatment of chronic prostatitis. E. G. Ballenger (*American Medicine*, Nov. 12, 1904).

**Diagnosis.**—Chronic prostatitis must be differentiated from chronic cystitis, vesical calculus, hypertrophy of the prostate, and seminal vesiculitis. In the first of these the characteristic discharge, the mental depression, and the prostatic tenderness will be absent. If the urine be passed in two portions in the case of prostatitis the cloudiness will be in the first portion only, while the second portion will be clear. In inflammation of the bladder the two portions would be alike. Vesical calculus would be excluded if the characteristic symptoms are not present, and finally by demonstrating its absence by the careful use of the sound. Hypertrophy of the prostate usually begins after the fiftieth year of life, and is much more common after the sixtieth year. The distinction will sometimes be difficult to make, because patients with hypertrophy not infrequently have some degree of chronic inflammation associated. The cardinal symptoms of chronic inflammation,—the discharge of prostatic fluid and the cloudy condition of the first portion of urine as determined by the two-glass test,—together with the mental condition would point to inflammation of the prostate, and their absence would argue against it. Inflammation of the seminal vesicles, when chronic, gives rise to symptoms more closely simulating chronic prostatitis than any of the other conditions mentioned. There is apt to be persistent urethral discharge. Pain may be complained of in the back, over the pubes, or in the bladder, and occasionally the rectum or perineum. Digital exam-



ination through the rectum will, however, show an absence of changes in the prostate, and will probably reveal a distended seminal vesicle. As a means of reaching a conclusion in doubtful cases Posner, of Berlin, has proposed the following method: An ounce or two of urine is passed in one glass and a similar portion in a second glass, a quantity still being retained in the bladder. The prostate is then to be thoroughly expressed by massage either by means of the finger introduced into the rectum or by an instrument devised for the purpose. The patient is then requested to pass the last portion of urine. If chronic prostatitis be present this portion of urine will be found to be cloudy and the microscope will show pus-corpuscles, shreds, epithelium, and probably micro-organisms. Gonococci have been found in many cases. In making this test care must be taken not to confound the fluid from a distended vesicle, if one exist.

**Etiology.**—Chronic inflammation of the prostate develops insidiously as such, or it remains as a sequel of an acute inflammation. Among the causes which are responsible for chronic prostatitis are irritating injections; injuries from improper use of urethral instruments; foreign bodies, such as prostatic calculi; and conditions which cause a chronic congestion, like constipation, hæmorrhoids, etc. There is also probably a chronic pyogenic infection in which either the dose of the germs is so small or the virulence so mild that but a mild reactionary inflammation results. Such cases may complicate chronic gonorrhœa and urethral strictures.

**Treatment.**—Every factor which tends to cause congestion of the prostate should be taken away as far as possible. Therefore a contracted meatus, a stricture of the urethra, constipation, etc.,

should receive appropriate treatment. Sexual excitement should be avoided. Tonics are frequently indicated on account of the rather depressed condition of the health. The diet and digestion should receive attention as well as the matters of exercise, bathing, etc. Irritating articles of diet—such as Cayenne pepper, mustard, sauces, vinegar, pickles, tomatoes, and other acid vegetables and fruits—are to be avoided. Counter-irritation to the perineum—obtained by the daily application of equal parts of tincture of belladonna and tincture of iodine or by the occasional application of blistering collodion—will be beneficial. The daily use of a jet of cold water on the perineum from a bidet is of value in most cases. The low temperature of the water and the force of the stream both tend to cause reflex contraction of the blood-vessels and relief to the congested organ. In some cases the hot hip-baths for a few moments each day will be beneficial. In the rebellious cases silver nitrate may be introduced into the prostatic urethra with advantage. The application is made by means of a specially-designed syringe with a long, hard-rubber nozzle. In beginning the treatment, 3 to 5 drops of a 1-per-cent. solution should be introduced. This may be repeated at the end of from three to five days. The strength of the solution may be very gradually increased; but, if this be done too rapidly or if the primary application be unduly strong, it will result in considerable inflammatory reaction and distress to the patient.

Feleki and others believe that massage is the ideal and the rational therapy for chronic inflammation of the prostate. It empties the ducts, improves the circulation, and tends to cause absorption of the inflammatory products. For this procedure the patient may lie on the

back with the thighs flexed and separated. The massage may be performed either with the finger or with an instrument devised for the purpose. The *séances* may last from three to ten minutes, and may be repeated two or three times weekly. The gland should be rubbed from the periphery toward the urethra, and from right to left and left to right alternately.

In using tubes for rectal douching in chronic prostatitis, in order to apply moist heat directly to the gland it is necessary to have concavity near the end of the instrument to fit over the convexity of the prostate, so that when the inflow is taking place the hot fluid as it comes out of the tube flows right against the gland which one is desirous of treating.

In regard to the fluids to use in giving these douches or irrigations: Hot saline solution is one of the best, and in some cases where perhaps it is not as efficacious as one would like to have it, especially in the acute cases, hot flaxseed-tea, strained, is very grateful to the patient.

Patients should take it just as hot as they can stand it. Certain men say that rectal douches for the relief of prostatitis and seminal vesiculitis ought not to be given at over a temperature of 105 degrees, but often patients can stand it as high as 120 degrees, and it appears to do more good the hotter it is. Ramón Guitéras (*Jour. Cutaneous and Genito-Urin. Dis.*, Feb., 1900).

### Abscess of the Prostate.

**SYMPTOMS.**—The cases which go on to suppuration will present all the symptoms of acute inflammation in a marked degree. The temperature will be high, the pain severe and of a throbbing character, and chills are apt to occur. The diagnosis will be confirmed if an area of softening or fluctuation can be detected by digital examination.

**ETIOLOGY.**—Acute inflammation of the prostate may undergo resolution, it may result in chronic inflammation, or,

finally, in the formation of an abscess. Abscess will be more apt to occur in the cases in which the treatment has been neglected or the health of the patient particularly depressed. Suppuration may occur early or late in the course of the disease. There may be a single abscess or a number.

Prostatic suppuration is most frequently due to the gonococcus. This is prone to affect the follicles of the gland rather than the substance of the prostate. As the result of the lowered resistive vitality consequent upon chronic gonorrhœa of the posterior urethra, secondary infection of the prostate is liable to take place. The microbes most frequently concerned are staphylococci, streptococci, and the bacillus coli communis. Recently an anaërobic bacillus has been described as occurring in very acute prostatic conditions; this form of prostatic abscess, however, is specific and is apt to be followed by gangrene and the production of very foetid pus. Pseudo-abscess of the prostate, due to infection of the follicles of the gland from the urethra, is apt to be multiple. This condition does not, as a rule, give many symptoms, nor does it require operative interference. True prostatic abscess should be opened at the earliest possible moment in order to avoid complications, and Dr. Alexander's suggestion as to early diagnosis and treatment will undoubtedly prove to be of the greatest value in this matter. John Van der Poel (*Medical News*, May 31, 1902).

**TREATMENT.**—As a rule, the abscesses open spontaneously into the urethra, and complete recovery occurs. As soon as distinct fluctuation is detected, however, it is desirable not to wait for this event, but to evacuate the abscess by an incision in the perineum, avoiding both the urethra and the rectum. The cases in which this will be necessary are, however, comparatively few. The wound should be packed with gauze and redressed daily.



Prostatic abscess may burst of its own accord into the rectum, perineum, or urethra. But the latter event is usually brought about by efforts to relieve retention. They not infrequently refill and burst only to refill again. Incision and drainage will effect the necessary cure, should they fail to heal naturally. Campbell Williams (Clin. Jour., June 9, '97).

### Prostatorrhœa.

This term refers to the periodical discharge from the urethra of a colorless or slightly turbid, whitish, viscid fluid, most frequently observed after a constipated stool, but, in pronounced cases, also at other times.

Prostatorrhœa is perhaps invariably a symptom of chronic prostatitis or of inflammation of the seminal vesicles; the subject has therefore been treated under the former heading.

### Hypertrophy of the Prostate.

**Symptoms.**—There may be a considerable enlargement in the size of the prostate without any subjective symptoms whatever. On the other hand, a very moderate or slight enlargement in other cases may give rise to considerable annoyance. The first symptom which attracts the patient's attention almost without exception is increased frequency of urination. This is especially noticed at night. Patients observe that they are obliged to rise once or twice during the night to pass water. No change is noticed usually at this stage during the day. The nocturnal frequency gradually becomes greater, and finally the diurnal frequency is also increased. If the patient be particularly observing, he will note that the natural force of the stream is lacking; that it tends to fall vertically downward, instead of being directed outward away from the body. There is also apt to be some hesitation of the stream in starting,

and the stoppage is frequently incomplete. The subsequent course of the case depends, to some extent, upon whether the urine remains sterile or whether it becomes infected. In the former case, as the overgrowth of the prostate becomes more and more pronounced, there is a corresponding obstruction offered to emptying the bladder. The result is that at the conclusion of each act of urination a certain portion of the urine remains. The normal capacity of the bladder is therefore reached much earlier than would be the case if the viscus had been completely emptied. This is the cause of the more frequent passage of urine. When the amount of residual urine reaches several ounces to a pint or more, it naturally requires but a short time for the bladder to become fully distended and to call for relief. In some cases the obstruction is so great that normal urination is impossible; the bladder becomes distended to its utmost limit, when the urine escapes voluntarily from the urethra as fast as it enters the bladder from the kidneys. This dribbling is a most significant symptom, and one which constantly deceives the patient and not infrequently the physician, the argument being that, owing to the frequent or almost constant passage of urine, the bladder must be empty.

If the urine becomes infected, the symptoms become very marked. The frequency of urination may be every two hours, every hour, or even three or four times within an hour. There may or may not be hypogastric pain, depending upon the degree of cystitis present, and the act of urination is apt to be attended with vesical tenesmus. In rare cases in which there is moderate enlargement of the prostate, but in which the symptoms may have been so mild as to escape observation, after the patient has gone an

unusually long time without passing water, he may find himself unable to do so, and resort to the catheter will be necessary. This retention may be the first evidence which the patient has had that the prostate is affected.

The amount of pain varies in different cases. In the milder forms of the affection it is usually entirely absent. In more pronounced types of the disease the patient will complain of indefinite pains in the hypogastrium, the groins, or small of the back, and a sense of fullness in the perineum or rectum. In the later stages more or less severe pain will be present either as a result of a distended bladder or of cystitis. There may be a soreness or smarting of the urethra and shooting pains in the glans, similar to those felt in cases of stone in the bladder. In the cases accompanied with severe cystitis in which there are frequent and violent efforts made to pass water the tenesmus which is present may result in the production of hæmorrhoids or of prolapsus ani. In the later stages of the affection the urine is very apt to contain blood, sometimes in microscopical quantity only, while in other cases the amount of bleeding is very great. As long as the bladder remains uninfected there are no characteristic changes in the condition of the urine. In the presence of infection the usual evidences of cystitis will be observed. The enlarged prostate sometimes causes a marked erethism or even priapism. The presence of residual urine and the ammoniacal decomposition which is apt to result predispose to the formation of phosphatic calculi, and it is a matter of common experience that patients suffering from enlargement of the prostate frequently have a stone in the bladder.

**Diagnosis.**—The diagnosis of enlarge-

ment of the prostate is, as a rule, attended with little or no difficulty.

Among the conditions which may give rise to symptoms more or less similar are stricture of the urethra, prostatitis, cystitis, vesical calculus, and the various tumors which are met with in the bladder. Stricture of the urethra will be eliminated if a full-sized urethral instrument can be passed without meeting an obstruction. Prostatitis, if acute, would be most apt to follow urethritis, and would be accompanied by fever and much more marked local tenderness than will be observed in the case of senile hypertrophy. The chronic form usually occurs in earlier life, and is accompanied by the characteristic symptoms given under the discussion of chronic prostatitis. Vesical calculi, if present, would be detected by the use of a vesical sound. Vesical tumors are rare; they would be suspected after excluding stone and enlarged prostate. The cystoscope may assist in arriving at a positive conclusion. The final test for enlargement of the prostate is digital examination, through the rectum, by which means we are able to detect the presence or absence of any increase in size. The patient should also be examined invariably for residual urine, by passing a catheter immediately after he has emptied his bladder as completely as possible. The length of the urethra is increased in hypertrophy of the prostate in some cases to the extent of one and one-half to two inches, which fact should be borne in mind in passing the catheter. In some cases the use of the cystoscope may be of material assistance in reaching a diagnosis.

In examining patients for enlargement of the prostate it is essential to keep to a routine position, such as bending over a chair with the body at right angles to the legs, because the form, position, and consistency of the gland alters greatly



with the position of the patient. In tuberculosis deposits should be detected in the testicle, epididymis, prostate, or bladder, in about 80 per cent. of the cases. E. Hurry Fenwick (*Brit. Med. Jour.*, Feb. 18, '99).

**Etiology and Pathology.**—After a large number of post-mortem dissections Sir Henry Thompson claimed that 1 man in every 3 over fifty-four years of age showed some enlargement of the prostate. In about 1 case in 7 the enlargement was sufficient to cause some degree of obstruction, and in 1 case in 15 the degree of enlargement was sufficient to demand some form of treatment. The enlargement of the prostate is so common at and after the sixtieth year of life that some writers have described it as physiological. This view does not seem justified, however, inasmuch as in perhaps two-thirds of the population there is no increase in size whatever.

Much has been written upon the etiology of this affection, but without adding anything to our knowledge of the subject. It seems to occur with about equal frequency in the various classes of society; nor do the habits of the individual, so far as can be learned by inquiring, seem to bear any relation to the condition.

The general term hypertrophy or enlargement is applied to the different conditions of the prostate occurring after the fiftieth year of life which result in an increase in its size. It is not intended, of course, in this statement to include the inflammatory affections of the prostate. In some cases the increase in size appears to include all of the structures of the gland in about an equal degree: a true hypertrophy. In other cases there is a circumscribed overgrowth involving only one portion or one lobe, which, strictly speaking, should be termed hyperplasia. Besides these two forms,

true tumor formations are occasionally met with.

The normal prostate consists chiefly of two lateral lobes with a small intermediate portion sometimes called the middle lobe. These may all be equally enlarged or the overgrowth may involve but one or two of the three portions. If the overgrowth is composed chiefly of the glandular elements of the prostate the tumor is, comparatively speaking, a soft one. While if it be composed chiefly of the fibrous and muscular stroma it will be very hard to the touch.

Among 433 cases suffering from prostatic hypertrophy, only 18 showed clinical evidence of previous prostatitis. These 18 presented no marked difference in point of size of the prostate, or of beginning of the disease to differentiate them from the remaining 415. Comparison of these 18 cases with 54 cases of chronic prostatitis without hypertrophy showed that the proportion of such cases suffering from prostatic hypertrophy varied little from the normal. Prostatitis lasting more than ten years probably tends to produce prostatic atrophy rather than prostatic hypertrophy. Therefore, if it is true that hypertrophy of the prostate is pathologically referable to inflammation, the clinical data suggests that this inflammation is either early gonorrhœa of relatively brief duration or some obscure sclerotic process associated with advancing years. The late date at which prostatic hypertrophy begins and its infrequency, compared with that of early gonorrhœa, make it seem clinically most improbable that early gonorrhœa is the cause. E. L. Keyes (*Journal American Medical Association*, July 16, 1904).

**Treatment.**—As we do not know any prophylactic treatment for hypertrophy of the prostate, and inasmuch as the symptoms of which the patient complains are not those referable to the prostate, but to the function of urination, no particular treatment is to be advised

until the abnormal conditions are sufficiently marked to cause some annoyance. In the earlier stages, with slightly-increased frequency of urination only, the patient's comfort may be very much increased by careful attention to hygiene. As the prostate, the seat of hypertrophy, is in a condition of chronic congestion, everything which tends to increase this should be avoided. The body should be well protected by proper clothing in order to avoid catching cold. The food should be plain, easily digested, and non-stimulating; a diet consisting largely of milk is to be recommended. The function of the bowels should also be attended to. Regular, moderate exercise is desirable rather than the reverse. If the amount of residual urine present be three or four ounces, a soft catheter should be passed once daily, preferably at bed-time so as to give a longer period of rest at night. If the quantity be five or six ounces, it should be withdrawn morning and evening, and, if half a pint or more, it is desirable to pass the catheter every eight hours. After withdrawing the urine it is desirable to irrigate the bladder with warm, boric-acid solution, 10 or 15 grains to the ounce. If there be pronounced cystitis present it may be necessary to pass a catheter more frequently, and the irrigations of the bladder then become especially important. No drugs have any direct influence upon the prostatic overgrowth unless it be ergot, and opinion as to the value of this remedy is divided. If it be decided to employ it, half a teaspoonful may be administered three times a day for a considerable period. Strychnine and other tonics will frequently be indicated for the general conditions.

In catheterizing patients who have enlarged prostates more or less difficulty is frequently experienced as the instrument

reaches the prostatic urethra. For this reason it will be necessary in some instances to try different forms of catheters. The elbowed catheter is one of the most useful in difficult cases, and the metal prostatic catheter, which has a longer shaft and a larger curve, will sometimes pass easily when all other forms are arrested. It should be an invariable rule to use thorough asepsis in all of the urethral instrumentation, in order not to induce cystitis.

When catheterizing in hypertrophy of the prostate gland, the soft catheter with solid tip is the best to use if possible. If a rigid one be required, one made of elastic webbing, with a curve or bend at the point, is preferable. A new catheter must be treated with the same care as to cleanliness and asepsis as one that has been in use. If possible, it should be exposed to the vapor of formaldehyde; if not, it should be immersed in a solution of formalin (1 to 2 per cent.) during at least fifteen minutes. Then it should be placed in a strip of bichloride gauze, or placed between the folds of a perfectly clean towel. Each catheter should be kept in a separate receptacle or closed drawer, where dust cannot find access to it, and where it cannot be handled except by the person who is to use it. If the patient must carry the instrument about with him, it should be kept wrapped in several layers of bichloride gauze, and outside this should be placed a wrapping of "waxed" or parchment paper, held firmly by rubber bands. Just before using the catheter the patient must thoroughly clean his hands, and rinse his fingers in pure alcohol. In the meantime the catheter should be lying in formalin solution. Then, after shaking it, and wiping off any drops that may remain upon it with a piece of clean gauze, and smearing it with a proper lubricant, the patient should gently pass it along the urethra. Immediately after use the catheter should be thoroughly washed with soap and water, be steeped for a time in the solution of formalin, and then



carefully put away in gauze or clean towel. Bangs (*Med. News*, Feb. 12, '98).

The underlying cause of the usual form of prostatic enlargement and of certain forms of prostatic atrophy is a slow formation of new connective tissue due to infection or to infection aggravating a senile degenerative process. The gonococcus is probably most often the specific infection, because (*a*) of its great frequency; (*b*) other inflammatory causes are not common in the parts in question; (*c*) a great similarity exists between the histology of gonorrhœal processes and those seen in these senile prostates. Neoplasms, fibromyomata, and adenoma occur, but may be called rare. Crandon (*Annals of Surg.*, Dec. 5, 1902).

**Operative Treatment.**—Of the operative procedures which have been recommended for enlarged prostate, those which seem to-day to deserve mention are: (1) vasectomy; (2) castration; (3) Bottini's operation; (4) cystotomy, for drainage, either perineal or suprapubic; (5) prostatectomy.

Of a number of operations all having the same object in view, that one is to be preferred, other things being equal, which accomplishes the object as completely as any other, with the least destruction of tissues involved, and with the greatest safety to the patient.

There can be no doubt but that the above ends are best attained by the perineal operations when done in accordance with their best technique. It is consequently the method of choice. This is not to say, however, that it is the only operation which should be used. On the contrary, both the suprapubic and the Bottini have a well defined place. The former is the operation to be preferred in cases in which a very large middle lobe makes the perineal operations especially difficult. The Bottini operation is to be preferred to either of the others if the patient's condition is such as to expose him to the danger of shock or post-operative pulmonary complications; and finally, if one or another of the limitations to the

performance of the Bottini operation is present, or there is too grave a general condition of the patient to warrant the employment of the Bottini, and if something must be done to relieve him, a palliative operation for drainage should be performed. The nature of the local conditions should be determined beforehand by means of the cystoscope. F. S. Watson (*Boston Medical & Surgical Journal*, April 28, 1904).

VASECTOMY, which grew out of the operation of castration, recommended by White in 1893, is distinctly the mildest of the various operative procedures employed in the treatment of hypertrophy of the prostate. In spite of the apparent insignificance of this operation, it has been followed by a small mortality. This is to be explained by the condition of the patients at the time of operation. They are all persons in advanced years who have suffered from chronic obstruction for some time, and who, in consequence, are apt to have cystitis, dilated ureters, and surgical kidneys. Even the introduction of a catheter in some of these cases is followed by fatal consequences. Statistics show that relief, more or less pronounced, follows vasectomy in about 60 per cent. of the cases, in some of which the conditions seem to return approximately to the normal. This operation is to be recommended after the various methods of palliative treatment have failed to give relief. Such patients usually have a moderate degree of enlargement, several ounces of residual urine, and the difficulty or pain caused by passing a catheter is so great as to demand some other form of treatment. If in addition to these the patient is old and feeble, and if it seems probable that he would not stand a more severe operation, vasectomy should be performed. If this fails to give relief one of the other operations may be performed later.

Resection of the vasa deferentia is particularly indicated in the middle period of prostatism when the patient's troubles—cystitis, hæmaturia, and complete or incomplete retention—are usually the result of congestion. In a later stage, in which the enlargement and deformity of the prostate are due to well-developed structural changes, resection of the vasa deferentia, though it may render service by relieving pain, will necessarily fail to do much good. Nové-Toperand (Lyon Méd., Oct., '96).

Vasectomy is of no service in cases of prostatic enlargement characterized rather by intravesical projection than by general increase in bulk. When this condition is present and the obstruction is due to a small nodule, the Bottini operation is especially applicable. Nicolich (La France Méd., Dec. 23, '98).

Vasectomy is specially effectual in the early stages of prostatic hypertrophy. When the prostate has assumed the form and structure of a fibrous growth, some other form of prostatectomy is preferable to either vasectomy or castration. When secondary changes have taken place in the bladder itself, in the form of sacs or trabeculæ, the possibility of restoring its natural functions by any means is extremely unlikely. Reginald Harrison (Lancet, May 5, 1900).

CASTRATION is indicated in cases in which the bladder symptoms are such as to demand a more prompt result than is apt to follow vasectomy. If the patient be between the ages of sixty-five and eighty years, with marked obstruction and cystitis, and if the vitality be fair, castration offers a better prospect of relief with a smaller mortality than the other operations mentioned. Of course, it is necessary to fully explain to the patient in advance the nature of the operation and to secure his consent. An analysis of the cases subjected to castration shows that in rather more than 80 per cent. of the cases there was marked improvement. The figures are as follow: Rapid atrophy of the prostate, 87 per

cent.; disappearance of long-standing cystitis, 52 per cent.; return of vesical contractility, 66 per cent.; amelioration of the most troublesome symptoms, 83 per cent.; and a return of local conditions not very far removed from normal, 46 per cent. (For a full discussion of this subject see article by J. William White in the Annals of Surgery, Aug., '95.) In 93 cases of which accurate notes were kept the prostate underwent atrophy in 83 per cent. (P. Bruns). Of 99 carefully analyzed cases there were 9.8 per cent. of failures; 6.6 per cent. was followed by moderate improvement, and substantial or very great improvement was noted in 83.6 per cent. (Cabot). The mortality from this operation has been 7 per cent., omitting the cases that died from causes having no connection with the operation. It would be much lower had not many cases already *in extremis* been castrated. It will be less in the future, as we learn better how to select cases for this and for the other procedures recommended for prostatic hypertrophy.

Castration diminishes hypertrophy of the prostate, especially when the enlargement is of the glandular form. This atrophy may not begin for six months or even more after operation, and may progress for more than two years. However, in certain cases, it is probable that there may be no atrophy. Out of 124 cases operated upon by castration the mortality was 14.5 per cent., due, in the main, to antecedent infection of the kidneys. Contrasting this mortality with that of the prosthetics received in the Hospital Necker and not submitted to operation, the figures stand at 14 per cent.: *i.e.*, 31 deaths in 220 cases. This operation should be rejected in cases of renal infection, in cases where the patient is extremely ill, and in cases which can be cured by simpler means. Albarran and Motz (Ann. des Mal. des Org. Gén.-urin., Jan., '98).



Relations which the prostate glands bear to the fecundative power of the spermatic fluid. Series of experiments instituted in which the gland in white rats was excised in part and in whole, and its effects on fecundity noted. They showed that a removal of the anterior lobes of the prostate gland in rats has no effect on breeding; but in a certain number it diminishes the fecundating power; and in a few it is destroyed entirely. Complete excision had a very marked effect on fecundity, reducing it to almost *nil* when the gland was entirely removed.

Partial or complete removal of the prostate had no effect, however, upon the sexual desire and capacity.

Complete removal of the gland in the adult animal had no effect on the histological structure of the testicles. In the young animal it had no effect upon the subsequent development of the testes. George Walker (Johns Hopkins Hosp. Bull., Mar., 1901).

**BOTTINI'S OPERATION.**—This method of treatment has recently been revived, and with the improved instrument is doubtless destined to meet the requirements in certain cases better than any other. It would seem particularly suited to the cases in which there is a distinct bar at the neck of the bladder. The operation is carried out by means of a prostatotome which is constructed somewhat on the principle of a lithotrite. What would correspond to the male blade, however, has at the extremity a platinum-wire loop which is heated by means of an electric current. After the instrument has been introduced the blades are turned in the direction in which it is desired to make the section of the prostate, the current gently turned on, and the wire loop made to cut through the obstructing mass by means of a screw which is attached to the handle. A second and a third section may be made if it is thought necessary.

Before beginning the operation the bladder should be partially filled with boric-acid solution, and during the time the instrument is being used a current of cold water is kept constantly passing through it in order to prevent it from becoming overheated. The recent reports upon this operation are of an encouraging character, but a still wider experience is necessary before it will be safe to express a final opinion as to its merits. That it, in common with the other operations mentioned, has a distinct mortality there is no doubt. The necessity for conducting the operation entirely in the dark and without any possibility of a safe guide is a theoretical objection that cannot be entirely overlooked.

Statistical analysis of 683 cases of Bottini's operation for prostatic hypertrophy. The mortality was 5 per cent., and the proportion of failures 6 per cent. Good results were obtained in 88 per cent., about two-thirds of the latter being cured. The cause of failure is nearly always inadequate division of the obstruction. Too short an incision is, perhaps, most frequently the cause. An incision at most  $4\frac{1}{2}$  to 5 centimetres in length is adequate. Freudenberg (Klin.-therap. Woch., No. 18, 1900).

Bottini's operation resorted to 30 times on 24 cases. In 9 cases there was a lasting cure, and 7 cases were much improved. There were 2 immediate and several remote deaths after the operation. Cures were about 30 per cent., improved cases rather under 30 per cent., and the mortality 16 per cent. Willy Meyer (Med. Record, lvii, 705, 793, 1900).

Among the symptoms which follow the operation is frequent urination. Hæmaturia is not infrequent, but generally subsides within two or three days. Fever appears more or less frequently and epididymitis occasionally. The post-operative period is nearly three weeks and the after-treatment of these cases is as important as the oper-

ation itself. The patient should not be allowed to pass from observation until the urine is clear and all symptoms of irritation have passed, and, if possible, the bladder should be explored with the cystoscope. Among the complications which follow the operation incontinence of urine must be mentioned. It occurred in 2 cases out of the writer's 36. Sixty per cent. have discontinued the use of the catheter; 20 per cent. have an increased amount of spontaneous urination and are able to reduce the use of the catheter from one-half to only that which is required for occasional treatment; 20 per cent. received no benefit, or, if any, but very little. The largest percentage of cures was among the patients wholly dependent upon the catheter. Bangs (Med. Record, Mar. 9, 1901).

Results personally obtained in 161 operations for the relief of senile hypertrophy of the prostate gland suggest the following conclusions:—

Success following the Bottini operation depends on having perfect instruments, a good battery, the necessary skill, and the employment of a proper technique. In suitable cases the Bottini is the safest and best radical operation thus far advised for the relief of prostatic hypertrophy. It is often very efficacious in advanced cases of obstruction as a palliative measure, rendering catheterism easy and painless, relieving spasm, lessening the tendency to constipation, and improving the general health. It is of especial service in the beginning of obstructive symptoms due to hypertrophy of the prostate gland, and may be regarded as a means of preventing catheter life. It is indicated in all forms of hypertrophy except where there is a valvular formation, or where there is an enormous overgrowth of the three lobes associated with tumor formation, giving rise to a pouch, both above and below the prostate gland. Where the bladder is hopelessly damaged, together with a general atheromatous condition of the blood-vessels, associated with polyuria, results are negative. Pyelitis is not a contra-indication to a resort to the operation. The

character of the prostatic growth has no bearing on the results of the operation.

The ligation of the internal arteries for the relief of hypertrophy of the prostate gland, first recommended by Bier, has been tried by several surgeons with very unfavorable results. The benefit derived from the operation is slight, and the mortality higher than that following prostatectomy. Thus far, the results derived from angioneurectomy have been negative. Orville Horwitz (Phila. Med. Jour., June 22, 1901).

CYSTOTOMY, either perineal or suprapubic, may be carried out either with the view of temporary drainage or of establishing a permanent new channel for the escape of the urine. In the former case the physiological rest which the operation affords results in sufficient relief of prostatic congestion to permit the urine to flow through the normal channel. If the urethral flow cannot be re-established, a tube may be inserted into the bladder for permanent drainage. Several forms of these tubes have been devised. The operation is only to be recommended in cases in which the urethra is absolutely obstructed and the patient rejects vasectomy and castration. The annoyance of wearing the permanent tube, the irritation of the surrounding skin, and the continual soiling of the clothing render the patient's life anything but happy.

Suprapubic cystostomy for prostatic enlargement is recommended: 1. In those cases of enlarged prostate in which there is a mechanical and more or less insurmountable difficulty in urinating, and in which catheter-life is impossible, from whatever cause. 2. In cases in which septic infection is the prominent feature, and is the source of danger to the patient, where cystitis persists in spite of skillful catheterization and irrigation of the bladder. The mortality depends, not upon the operation *per se*, but upon the conditions for which it is per-



formed. The state of the kidneys bears about the same relation to the mortality in operations on the bladder as the state of the intestine in operations for strangulated hernia. Poncet (Lyon Méd., No. 32, Aug. 7, '98).

PROSTATECTOMY must always be regarded as a formidable operation. There are rare cases in which a pedunculated growth of the middle lobe or a more or less circumscribed enlargement of one portion of the prostate may be easily and safely removed through a suprapubic opening. The removal of the entire gland either suprapubically or by the combined suprapubic and perineal methods is often a slow and tedious procedure and one which is usually attended with severe hæmorrhage. The class of cases in which this operation may be recommended includes those who are still comparatively young and active, whose prostates are of the harder variety, and in whom castration is not to be recommended for sentimental reasons, or because of the age of the patient.

In operating for the radical treatment of prostatic hypertrophy the patient is placed flat on his back; the bladder is carefully washed out, and then left moderately distended, to the extent of from eight to twelve ounces. Then the bladder is opened suprapubically. The forefinger of the left hand is now introduced into the bladder, the location and extent of the prostatic obstruction are determined, and the vesical opening of the urethra is located. In the right hand is grasped a pair of serrated-edged scissors with a long handle. These scissors are slipped along the left forefinger to the urethral opening, and are made to cut through the bladder-wall in that region. The cut extends from the lower margin of the internal vesical opening of the urethra backward for an inch to an inch and one-half.

Then one of the forefingers is slipped through the vesical hole made by the serrated scissors, while at the same time the fist of the other hand makes firm

counter-pressure against the perineum. By means of this counter-pressure the prostatic growth is brought well into the reach of the forefinger, which is employed all this time in enucleating the prostatic obstruction, *en masse* or piece by piece. Enucleation should not be desisted from until all the lateral and median hypertrophies, as well as all hypertrophies along the line of the prostatic urethra, have been removed.

A perineal section is then made, and a large-sized (No. 26 American) soft-rubber tube is passed through the perineal cut, and the cut through which the prostate was enucleated, into the bladder. After this, hot-water irrigation is employed for some minutes, to wash out blood-clots and to stop oozing. Then the suprapubic wound is closed by a deep layer of catgut sutures, which include the bladder-wall, and by a more superficial layer of silk-worm-gut (Florentine) sutures. About in the middle of the cut the catgut stitch is omitted and a deep Florentine-gut suture is taken, which includes the vesical wall and the whole extent of the lateral abdominal wall. This suture is not tied at the time of operation, thus allowing a rubber suprapubic drainage-tube to remain temporarily in position. At the end of four or five days this suprapubic drain may in most instances be removed; then this ligature can be tied. It is best not to remove these Florentine sutures till after the patient is up and about. One should avoid operating on individuals in whom the large surface arteries are felt to be atheromatous except for the relief of suffering, since the chance is against their recovery. Fuller (Med. Record, Nov. 19, '98).

In obstructive prostatic enlargement, perineal prostatectomy, combined with suprapubic cystotomy with perineal drainage, as devised by Alexander, is the best method so far practiced. The perineal wound is dressed, as is usual, after perineal section. The after-treatment consists in daily washing the bladder, the fluid being injected into the suprapubic tube. The suprapubic tube is removed on the fourth day and the lower tube three days later, after which the bladder is washed by a catheter passed through the

perineum. A full-sized sound is passed at the end of the second week, and every five days until the perineal opening closes. Both wounds have usually healed in the course of five weeks. If prostatectomy be resorted to earlier in the disease, while the patient's general condition is still good and while the bladder is not yet infected, and the ureters and the kidneys are still in a healthy condition, the mortality from the operation will be very considerably diminished; and a prostate thus successfully operated upon may be practically relieved or entirely cured of this most baneful disease. Parker Syms (*Annals of Surg.*, Mar., '99).

The time to resort to operative measures is just as soon as palliative treatment, carefully executed by competent hands, has failed to give relief. Complete prostatectomy is always the operation of choice, because it is the only operative procedure which cures or gives uniformly good results, when successfully performed in proper cases. The best time for its performance is just as soon as palliative effects have failed or are manifestly impossible of execution and before secondary changes in the bladder and kidneys, due to long-continued obstruction, have taken place. Paul Thorndike (*Boston Med. and Surg. Jour.*, Aug. 28, 1902).

### Tuberculosis of the Prostate.

**Symptoms.**—Perhaps one-third of the cases are either entirely free from symptoms or have so little inconvenience that the disease is unsuspected. In the milder forms of the affection there is slight irritation of the bladder, as evidenced by some frequency of urination, which may be attended with burning pain. There is a feeling of fullness or weight in the perineum, there may be a muco-purulent discharge from the urethra, and a similar sediment in the urine. Hæmaturia is also frequently observed. The disease usually occurs in anæmic persons who have tubercular foci elsewhere. It is met with chiefly between the twentieth and forty-fifth year.

**Diagnosis.**—A number of writers have referred to the similarity between the symptoms of prostatic tuberculosis and of vesical calculi. A consideration of the symptoms and careful exploration by the sound will serve to make the distinction. The presence of tubercular deposits in other portions of the body will always be an element to excite the suspicion of the physician and the finding of tubercle bacilli in the urine would be conclusive. Guyon states that the most careful examination fails to detect the bacilli in 50 per cent. of the cases. Digital examination per rectum might show some local enlargement.

**Etiology.**—This disease is believed to be invariably secondary to deposits elsewhere in the genito-urinary tract. The disease is usually manifested by circumscribed collections of cheesy material or by abscesses.

**Treatment.**—The disease can be, to some extent, guarded against if those who have a tubercular tendency avoid all influences that would tend to cause congestion or inflammation of the prostate. The treatment is chiefly constitutional unless the local trouble demands operative interference. It is proper to delay the latter as long as possible on account of the part not being very accessible and also because it is apt to be a part of a general process. Hill and others have injected iodoform and other substances into the bladder frequently with beneficial results. Hill's formula is as follows:—

R Iodoform, 2 parts.  
Mucilage of gum arabic, 4 parts.  
Glycerin, 2 parts.  
Water, 20 parts.

After washing out the bladder a drachm of this mixture is introduced. This may be repeated every second or



third day, depending upon how well it is borne.

In the treatment of tuberculous cases of the prostate the bladder should never be washed out, as the case progresses much more rapidly if this is done. E. Hurry Fenwick (Brit. Med. Jour., Feb. 18, '99).

The question of operation will frequently come up in cases of tubercular deposits in the prostate. In a general way it may be stated that, if the general health of the individual is good and if the tubercular process does not yield to any form of palliative treatment, an operation is indicated. The gland may be approached from the perineum and any diseased area thoroughly curetted, or it may be exposed by suprapubic cystotomy. If, however, the patient has deposits elsewhere in the body sufficiently pronounced to give rise to physical signs and if the general health be poor, operative treatment is not to be recommended.

#### **Tumors of the Prostate.**

Cysts of the prostate have been recorded, but they are of such rare occurrence that they are to be considered surgical curiosities. The forms that have been described are hydrops of the seminal vesicles, dermoids, and echinococcic cysts. These almost invariably cause retention of urine after they have reached a sufficient size to occlude the urethra by pressure. Upon examination by the rectum a fluctuating swelling may be detected. They are treated either by aspiration of the fluid, or by incision and drainage.

**CARCINOMA.**—Carcinoma of the prostate is also a rare affection. It occurs in two forms: a slowly-growing, circumscribed tumor, limited to the gland itself, and a diffuse infiltration of the prostate and base of the bladder which develops rather rapidly.

The symptoms of carcinoma of the prostate are those of obstruction from hypertrophy, except that they run a more rapid course. Carcinoma gives rise to more pain, however, than does senile enlargement, and as soon as ulceration occurs there is hæmaturia. Carcinoma of the prostate is exceedingly hard to the touch, and the inguinal mesenteric and retroperitoneal glands are occasionally affected. The most prominent features are the hardness of the prostate, the severity of the pain and its wide distribution, and the rapid course, with the development of cachexia. The cystoscope may be of assistance in reaching a conclusion.

*Treatment.*—The treatment of carcinoma of the prostate is chiefly palliative. The different indications are to be met as they arise. Excessive pain must be met by morphine internally or by suppository. Operations for the removal of a prostate in malignant disease have either proved fatal at the time from the operation or have had an early recurrence.

**SARCOMA.**—Sarcoma of the prostate usually occurs in early life. The common symptoms are dysuria, retention, hypogastric and perineal pain, and the presence of a tumor. Blood is usually present in the urine. This disease runs a more rapid course than any other affection of the prostate.

*Treatment.*—The treatment in this condition must also be symptomatic and palliative. An operation would be proper only in the most exceptional case. It is needless to say that the prognosis is absolutely unfavorable.

**Prostatic Calculi.**—These are of two kinds: those formed in the kidney or bladder and lodging in the prostatic sinus and those which form in the gland itself. They vary in size from a pin's

head to a nut. They may be either single or multiple.

The symptoms are those of inflammation of the neck of the bladder; occasionally the passage of urine is interfered with.

The diagnosis is usually made by passing a metal instrument, which imparts a grating sensation to the hand as it passes over the calculus.

Prostatic calculi may give rise to a mucoid or muco-purulent discharge. The stones may vary in number from one or two up to twenty-five or thirty or even more. They are most usually composed of phosphate of lime, but sometimes consist of carbonate of lime. They are of gray color, smooth, hard, roughly triangular in appearance, and perchance faceted.

Their presence in the prostate causes fullness, bearing-down pain, frequency of micturition, and discharge. They may set up retention of urine through causing swelling or from their size by impaction. Sometimes they can be felt by the finger per rectum. The introduction of a steel sound, if they are not imbedded in the substance of the prostate, will reveal their presence. They may be felt just as the beak of the instrument is passing into the bladder; or when the sound is in the bladder, if one presses the perineum on to the instrument, they will be felt to grate against it. Campbell Williams (Clin. Jour., June 9, '97).

*Treatment.*—A small calculus in the urethra may sometimes be removed by means of appropriate forceps; when this is impossible a median perineal urethrotomy will be necessary.

**Polyps of the Prostatic Urethra.**—Polyps of the prostatic urethra are very rarely met with. The most constant symptom is hæmorrhage from the urethra. There may or may not be difficulty in urination and in catheterization. The treatment is operative. The growth is removed through a median perineal incision.

### Urethral, Urinary, or Catheter Fever.

It not infrequently happens that a patient will have a chilly sensation or a very slight chill after an instrument has been passed into the bladder, especially at the time of the next urination. This is not followed by the hot stage or the sweat, and there is no elevation of temperature. The phenomenon is supposed to be of reflex origin, and does not constitute urethral fever. It is of no significance and requires no treatment.

In rare instances after instrumentation of the urethra the patient will be seized with a severe chill, which is followed by fever and sweat. There may be but a single paroxysm, in which case the patient's condition will have returned to normal in from a few to twenty-four hours. In other cases the chill, fever, and sweat recur at irregular intervals. The former is probably due to the absorption of a minute dose of poison through a fresh wound of the urethra caused by the instrumentation. The latter is undoubtedly a genuine septic infection. The micro-organisms or their toxins are absorbed through the urethral lesion, and produce either a septicæmia or pyæmia of the gravest type.

Urinary rigors are regarded as a form of septic poisoning due mainly, if not entirely, to the bacillus coli. The presence of the bacillus can be demonstrated in the vast majority of cases. It is certainly capable of producing toxins of sufficient virulence even when the dose is infinitesimally small. Everything that favors absorption increases the likelihood of rigors. Conversely, everything that checks it tends to prevent them. It is an error to speak of rigors like these by the name of urinary fever: fever due to reabsorption of some of the constituents of the urine. It overlooks the true cause, gives an entirely wrong impression, and, what is much more important, leads to a wrong method of treatment. C. Mansell Moullin (Lancet, Dec. 18, '97).



Patients who have suffered for a long time with stricture of the urethra and whose kidneys have become infected secondarily seem to be especially predisposed to this accident. The extreme gravity of the severer forms of urethral fever should constantly be borne in mind and every effort should be made to prevent its occurrence.

The treatment should be prophylactic, inasmuch as we are helpless in the presence of a fully-developed case of the severer forms. The most rigid antisepsis in urethral instrumentation and the internal administration of one of the urinary antiseptics will usually prevent urethral fever.

For some days beforehand the patient should be given 2 or 3 grains of salol six or eight times in the twenty-four hours. If the urine is alkaline from the presence of a fixed alkali benzonaphthol is to be preferred, given in cachets. Three days before operation the patient should be given a calomel purge and an effervescing draught, and again the night before.

The patient should be very warmly clad for the operation. Immediately before the operation the glans penis, prepuce, and meatus should be thoroughly washed with soap and water and then with corrosive-sublimate solution (1 in 1000). The urethra must be cleansed as perfectly as it can be with a boric-acid douche and a catheter that admits of a return-current along the walls.

The instruments should be sterilized and kept from contamination by wrapping them in a carbolyzed towel. At the end of the operation the bladder should be emptied by means of a catheter and two drachms of a 2-per-cent. solution of nitrate of silver injected into the deep part of the urethra and on to the face of the stricture and left there.

Micturition should be postponed for as long as possible after the operation. C. Mansell Moullin (*Lancet*, Dec. 18, '97).

When the writer first practiced the Bottini operation he frequently had cases that developed urinary fever—a

complication alarming to the patient and disagreeable to the surgeon, as it varies in severity from a simple and relatively benign urinary fever to a true pyæmia in which the prognosis of necessity became extremely grave. Clinical experience has shown that the internal administration of quinine, salol, urotropin, methylene blue, etc., is absolutely without benefit, but that camphoric acid in 3-grain doses, beginning some days before and continuing for some days after the operation, is an admirable prophylactic. Freudenberg (*Septième Session de l'Association Française d'Urologie*, 1903; *Amer. Jour. Med. Sciences*, July, 1904).

If the disease has already become established, the indication for the use of some remedy to render the urine sterile is imperative. Boric acid and salol have each been extensively used for this purpose. Ten grains of either may be administered four times a day. Recently urotropin and cystogen have been employed extensively, and apparently with very satisfactory results. The dose of each is 20 to 30 grains in twenty-four hours. The urethra and bladder should be thoroughly irrigated at frequent intervals with an antiseptic solution. One of the most efficient is potassium permanganate, 1-5000 to 1-2000. If absorption seems progressive in spite of these measures, it may be necessary to perform an external perineal urethrotomy for better drainage.

Urotropin is of value as an antiseptic for the urinary channels. Urinary antiseptics should be used for several days before operation upon the urinary tract. Urotropin has a lasting effect, 15 grains often extending its influence over a period of twenty-four hours. Nicolaier found that urine containing this substance could be kept for months without decomposition. It increases the acidity of the urine, and therefore in subacute cases must be employed cautiously or else combined with an alkali to prevent vesical irritation.

The dose of urotropin ranges from 15 to 90 grains in twenty-four hours, it seldom being necessary to employ a larger daily amount than 20 grains in order to obtain its antiseptic effects. This amount may be taken at a single dose in the morning dissolved in water, or may be given in divided portions during the day either in solution or in capsules. The most satisfactory results are reached by the administration of four 5-grain capsules each day, the last dose being taken late at night and each being followed by a copious draught of water. A. R. Elliott (No. Amer. Pract., Oct., '97).

The conclusions regarding urotropin from personal observations and others are as follow:—

1. Urotropin produces no untoward symptoms when administered in amounts of 30 grains *per diem*.

2. It renders an alkaline urine acid, no matter what the cause may be.

3. It inhibits the development of the micro-organisms of ammoniacal cystitis, and in this way clears up cloudy urine.

4. It is indicated as a preparatory disinfectant in operations on the urinary tract; in pyelitis, cystitis, and other inflammations of the urinary tract, irrespective of their cause, and in other conditions tending to the formation of urinary calculi. R. W. Wilcox (Med. News, Nov. 12, '98).

Permanent sound drainage is indicated in all cases of urinary infection and hæmorrhage from the urethra, whether prostatic or penile. A metallic, gum-elastic, or silk-web catheter is fastened and kept in the urethra; permanent drainage is thus secured for as long or as short a time as may appear necessary. The catheter should not be removed until the temperature has fallen to 99 degrees at night and the tongue has cleared. F. Guyon (La Presse Méd., May 5, 1900).

The constitutional treatment is also important. The patient will require a nourishing diet. Three pints of milk per day will not be too much, and 3 to 6 eggs should be given, either with the milk or separately. Stimulants must be administered freely. Half a pint of

whisky or brandy or even more may be given, with advantage, in twenty-four hours, the amount being determined by the effect. Full doses of strychnine should be given, and digitalis may be added if there is any evidence of enfeebled circulation. Careful attention must be paid to the functions of the kidneys and bowels.

### Injuries and Diseases of the Bladder.

**Exstrophy of the Bladder.**—Exstrophy, or absence of the anterior wall of the bladder, is a congenital defect occasionally met with. It results from the failure of the lateral portions of the urogenital cleft to unite. It is most frequently observed in male children, and is accompanied by absence of the roof of the urethra (epispadia) and by a defect in the anterior abdominal wall in front of the bladder, so that the mucous surface of the posterior wall of the bladder protrudes in the hypogastric and pubic regions. The ureteral orifices can usually be found by careful inspection. Subjects of this deformity are usually poorly developed and are apt to have other defects also. In some cases the scrotum is cleft, so that the external genitals of a male child may resemble somewhat those of a female. The testes are occasionally undeveloped, and may or may not occupy their proper position in the scrotum. Inguinal hernias are common. The constant contact of the urine with the surrounding skin gives rise to a troublesome eczematous condition.

The palliative treatment consists in the application of some form of urinal to collect the urine or of other means to keep the patient as dry as possible. The surrounding skin should be frequently bathed, and, if irritated, zinc ointment should be applied.

The radical treatment consists in some form of plastic operation, intended to



close in the bladder sufficiently to enable the urine to be caught in a suitable urinal. Of the various operative procedures, Wood's method is that usually recommended. In suitable cases it is advisable to free the edges of the bladder and unite them by sutures, leaving an opening below for the escape of urine. A few writers advise the transplantation of the ureters into the rectum. This is, however, a very serious operation, and one that has not yet been performed with sufficient frequency to establish its claim to a permanent place among legitimate operative procedures.

Wood's operation is performed by taking a flap of sufficient length and width, from the anterior wall of the abdomen, to cover in the extroverted border of the bladder, and the flap is folded over the protrusion so that the skin is next to the mucous membrane and the raw surface outward. Two rounded lateral flaps with the attached portion corresponding to the base of the scrotum and inguinal region on either side are next made. The inner end of each incision is continued along the corresponding side of the urethral groove for one-half its length. These flaps should be large enough and so fashioned as to meet in the middle line over the inverted middle flaps in their new positions. The middle flap is turned downward so that the skin covers in the bladder, and the free margin sutured to the incisions on either side of the roof of the penis. The lateral flaps are then brought together in the middle line overlying the first flap and sutured. The raw surfaces from which the flaps were taken are then drawn together as far as possible, using either sutures or harelip-pins.

The epispadic condition remains to be remedied by operation at a later period.

After personal operation for extroversion of the bladder there is less risk

of septic infection spreading from the bowel up to the kidney than there exists from the decomposition of urine and ulceration of mucous membrane, which so frequently complicate extroversion of the bladder. In the performance of the operation an elliptical portion of the vesical mucous membrane at the point of entrance of the ureters into the bladder, along with the nutrient vessels of the ureters, are to be carefully separated and to be inserted along with the ureters into the opening made in the sigmoid flexure. Maydl (*Wiener med. Woch.*, '96).

Of all the radical methods which involve an incision of the bladder and a transplantation of the ureters to the rectum, Maydl's operation is by far the most complete, rational, and satisfactory from the technical point of view; Maydl's operation offers the best conditions for the complete correction of the associate epispadias; it should not be applied indiscriminately to all cases, but only to those patients whose general condition is such as to warrant a long, tedious operation likely to be attended by serious shock and whose eliminating organs, especially the kidneys, are normal and capable of effective elimination. Rudolph Matas (*Phila. Med. Jour.*, June 10, '99).

**Rupture of the Bladder.**—Rupture of the bladder is usually the result of traumatism. The common causes are a forcible blow in the hypogastrium and fracture of the pelvis when the bladder is full. Rupture from overdistension is an accident of great rarity, and usually occurs in cases of obstruction due to enlargement of the prostate. The tear may involve that portion of the bladder-wall covered by peritoneum, in which case the lesion is said to be intraperitoneal, or, if the portion of the bladder involved is not in relation with this membrane, the lesion is described as extraperitoneal. The intraperitoneal ruptures result from the different forms of traumatism, excepting fractures of the pelvis, and constitute about four-fifths of the whole number. The extraperitoneal

cases are observed chiefly in fractures of the pelvis and in rupture from overdistension.

Statistics show that in Berlin in 10,867 surgical cases there were only 3 ruptured bladders, and in London in 16,711 cases only 2. In the Johns Hopkins Hospital, among 7000 surgical cases there have been 3 ruptured bladders.

Ninety cases of extraperitoneal rupture of the bladder have been personally collected; 84 occurred in males, and nearly 50 per cent. between the ages of twenty and forty. Twenty-three were due to crushing by weight falling on the body; 25 by being run over by a wagon; 22 from falling from a height. Mitchell (*Annals of Surg.*, Feb., '98).

Analysis of 100 recorded cases of extraperitoneal rupture of the bladder occurring in association with fracture of the pelvis. This injury is a very rare one. Out of 142,418 surgical cases, treated in three hospitals named, there were only 8 cases of rupture of the bladder. It occurs oftener now than formerly, on account of the greater frequency of accidents on railways, tramways, and in great engineering works. About 38 per cent. of cases of fracture of the pelvis are complicated by rupture of the bladder. Joisson (*Annales des Mal. des Org. Genito-urin.*, Sept., 1902).

The symptoms vary according to the nature of the accident. In cases of intraperitoneal rupture the patient will display more or less profound shock, severe hypogastric pain, and a desire to urinate. If a catheter be introduced carefully, a little blood or blood-stained urine may escape or nothing at all may be withdrawn. If now a few ounces of boric-acid solution be slowly introduced there will be no return-flow. This observation is diagnostic of rupture of the bladder if the manipulations are properly carried out. Symptoms of peritonitis may develop speedily or may be delayed, depending on the condition of the urine.

Extraperitoneal ruptures — that is,

those involving the base — are accompanied by less shock, unless there be other injuries, than the intraperitoneal variety. In cases of extraperitoneal rupture the rent in the bladder communicates with cellular tissue, but not with any cavity; so that the bladder does not empty itself as completely as in the intraperitoneal rupture. The urine, however, and any boric-acid solution that is used to irrigate the bladder, will return through the catheter more or less blood-tinged. The escape of the urine in the tissues gives rise to a cellulitis which will be manifested by pain and fullness locally and by an elevation of temperature, and the usual constitutional symptoms of a severe inflammation.

Rupture of the bladder is always a very serious accident. The intraperitoneal variety has a much higher mortality than the extraperitoneal, as would be supposed.

Of 90 cases of extraperitoneal rupture of the bladder, 75 died; *i.e.*, 83.3 per cent. Fifty-three of the fatal cases died in the first week—29 on the first day. Eleven cases were operated on within twenty-four hours; 4 recovered. Of 7 cases operated on between two and five days, none recovered. Of 7 cases operated on within two weeks, 5 recovered. Injuries complicated by multiple fracture in 42 cases. The mortality of the unoperated cases was 76.2 per cent.; that of the operative cases 64.9 per cent. Mitchell (*Annals of Surg.*, Feb., '98).

**Treatment.** — Intraperitoneal rupture of the bladder should be treated by immediate laparotomy, as the condition is otherwise certainly fatal either from peritonitis or from absorption of the urine, even if sterile. The rent in the bladder should be sewn up after the Czerny-Lembert method of intestinal suture, and the peritoneal cavity irrigated with normal salt solution. A catheter should be introduced and retained



for a week or ten days while the wound is healing.

In cases of intraperitoneal rupture of the bladder the following is considered as the proper course to pursue: The peritoneum should be opened and the rent in the bladder securely closed by closely applied silk sutures; the abdominal cavity is to be irrigated with hot sterilized water; only the upper portion of incision in its walls is to be closed, the lower end being filled with a tamponade of gauze passed to the bottom of the pelvis; the bladder should be drained by means of a large flexible catheter passed through a perineal incision, and maintained there by any device that fulfills the indication. C. K. Briddon (*Annals of Surg.*, Dec., '95).

The treatment of vesical rupture should be about as follows: Coeliotomy is the best method of reaching the bladder. It is best always to suture the bladder. The suturing of the bladder-wall and of the peritoneum should be done separately. In case peritonitis has already set in, rendering the separate sewing of the tear of the peritoneum impossible, a tampon should be put into the peritoneal cavity. The after-treatment should consist in the extensive use of iodoform-gauze packing. Fritz Berndt (*Archiv f. klin. Chir.*, B. 58, H. 4, '99).

The treatment consists in immediately making a free incision above the pubis, exposing the rupture, and if possible suturing it. In many cases it is impossible to introduce stitches, and all that can be done is to drain the pouch of Retzius. A catheter should at the same time be tied into the bladder. Joiiion (*Annales des Mal. des Org. Genito-urin.*, Sept., 1902).

Extraperitoneal ruptures are treated by the permanent catheter; irrigations of the bladder and careful examination should be made from day to day for appearances of extravasation and inflammation either in the space of Retzius or in the perineum. Digital exploration of the rectum will reveal any collection in the pelvis. Such evidence would call for immediate and free incision.

Immediate operation should be performed in all cases where a rupture of the bladder is known to exist.

In all intraperitoneal cases immediate laparotomy should be performed and the wound in the bladder sewed up.

In all cases where there is any doubt as to whether the rupture is extraperitoneal or intraperitoneal, immediate laparotomy should be performed.

In all extraperitoneal cases where there is any doubt as to the direction and extent of the extravasation, laparotomy should be performed at once for exploration and diagnosis, and should be followed by the operation appropriate for the drainage of the case.

There remain only the cases where the rupture is known to be extraperitoneal, and where the extravasation is known to be limited to the prevesical space, as the ones where it is safe to drain above or below, or both, without an investigation of the bladder and its neighborhood through an abdominal incision. Thorndike (*Jour. Cutan. and Gen.-Urin. Dis.*, May, '99).

### Vesical Calculus.

When certain of the solid constituents of urine are present in excess, a portion is thrown out of solution in the form of crystals. When a number of these crystals become adherent, a small calculus is formed around which, as a nucleus, additions continue to be deposited until a stone of some size is formed. A stone may form in the bladder primarily or it may develop around a nucleus which has had its origin in the pelvis of the kidney and has passed into the bladder.

Vesical calculi are composed in the order of frequency of uric acid, the earthy phosphates, and oxalate of lime. Stones composed of carbonates, cystin, xanthin, and indigo are occasionally met with.

The great majority of calculi are composed of uric acid. This form is usually

oval, of moderate size, and brownish in color. The surface, as a rule, is smooth. Uric-acid calculi are met with largely among children of the poorer families, and in adult life chiefly in those whose habits place them in the class popularly known as "free livers." The probable explanation of the frequency of stone in the former is that the food is unsuited to the time of life. In the better classes of society milk forms a large part of the diet of the child until it is several years old, whereas among the most dependent class the use of milk is discontinued as soon as the child is able to take solid food. The nitrogenous elements which are thus taken in beyond the requirements of the system are excreted in the urine in the form of uric acid, and, being in excess, tend to form calculi. In the latter class the liberal indulgence in rich foods and wines furnishes an amount of nitrogen far in excess of the needs of the economy, and the same condition results.

Phosphatic calculi occur in alkaline urine; they are therefore especially associated with the period beyond the middle life. They are apt to be associated with hypertrophied prostate, in which condition the constant presence of residual urine in the post-prostatic pouch with the accompanying ammoniacal decomposition which is so frequent in these cases furnishes all the conditions necessary for the formation of a phosphatic stone. These may be of any size. A number of instances have been recorded of phosphatic calculi which have weighed several ounces and less frequently as much as a pound or two.

Oxalate-of-lime calculi, like the uric-acid stones, originate, as a rule, in the pelvis of the kidney. They do not attain a large size; they are commonly more or less round in outline and dark brown in

color. The surface is frequently mammillated, which appearance has given rise to the name of "mulberry" calculus. These stones form in urine containing a free deposit of oxalate-of-lime crystals, which is termed oxaluria. This condition appears to be associated with disorders of digestion and assimilation, and is also present in certain forms of neurasthenia.

These different constituents are not infrequently found in association. For example, it is not uncommon to find calculi composed of alternate layers of uric acid and oxalate of lime, and either of these, or even a mixed calculus, is very apt to form a nucleus for the formation of a phosphatic stone.

The causes of stone in the bladder have already been hinted at. The continual use of food inappropriate to the age or condition of the individual, and the taking of excessive amounts of articles of diet which in their elimination produce uric acid or oxalate of lime, are the potent factors. In the formation of phosphatic stones any obstruction to the free emptying of the bladder, chronic cystitis, and other causes of alkaline urine play an active rôle. Considerably more than half of the vesical calculi met with are in patients under twenty years. By far the larger number of cases are met with in males. This is probably accounted for by the much greater facility with which a minute calculus can escape from the bladder through the much shorter and more dilatable female urethra. Stone in the bladder is of more common occurrence in certain sections of the world than in others.

**Symptoms.** — Symptoms of stone are frequent urination, pain, and changes in the character of the urine. The frequency of micturition varies greatly in different cases. It is usually greater dur-



ing the day, when the individual is active, than at night, when he is resting. In some instances urination is attended by considerable tenesmus. This is especially the case in children, and if the condition is pronounced is apt to lead to prolapse of the rectum from straining. Occasionally the stream of urine will be suddenly arrested by the stone rolling into the vesical neck. The pain may be constant or paroxysmal or both. As a rule, there is pain toward the end of micturition, which may be either hypogastric or just behind the glans. Sometimes there is a constant dull ache felt in the hypogastric region. This is especially the case with patients whose occupation subjects them to constant jarring motions, such as trainmen and those who drive over rough roads. The pain, like the frequency of urination, is increased by activity and lessened by rest.

The urine is apt to contain some traces of the material from which the stone is formed; so that the microscope may show either uric acid, oxalate of lime, or phosphates.

The presence of the stone usually gives rise to hæmaturia. The quantity of blood present is, generally, very slight, and is not apparent to the naked eye. In cases of long standing or in any case if cystitis has developed, more or less pus will be present.

Priapism has been occasionally observed in children, and in many cases various reflex pains are present.

The actual presence of a stone in the bladder is to be determined by a vesical sound or stone-searcher. This instrument has a shaft rather longer than the urethral bougie and a shorter curve. It should not be larger than about No. 13 of the French scale. The examination should be made with the patient in the recumbent position. It is desirable to

have some urine in the bladder, or in the absence of this to inject a small quantity of sterile boric-acid solution. In passing the instrument careful attention should be paid to every detail of antisepsis. When the instrument has been introduced the beak is to be turned downward and each portion of the bladder systematically examined. The presence of a stone will be indicated by the sensation imparted through the instrument to the hands of the surgeon, but especially by an audible "click" produced by gently striking the stone with the end of the instrument. The diagnosis should be made solely upon the latter, inasmuch as a ribbed bladder, especially if there be any phosphatic crusting, may give to the sense of touch the evidence of the presence of this stone.

In studying a series of 21 cases of encysted vesical calculus, it was noted that many of the symptoms ascribed to vesical calculus were wanting. In some cases the stone was so deeply imbedded in the bladder-wall as to elude the beak of the sound, and only proclaimed its existence when an attack of cystitis had supervened. The majority of these sacculi that are found to contain calculi are believed to be formed by the adhesion of the calculus to the bladder-wall and the formation of the sacculus for the calculus as it grows larger. There are no differential-diagnostic symptoms which separate this condition from ordinary cystitis. The difficulties in the way of diagnosis were enhanced by the fact that in several instances washing out the bladder was quite sufficient temporarily to restore the urine to a healthy condition. In several instances the stones were so thickly covered with mucus that they did not give an audible sound when struck with an exploring instrument. The fact that the presence of a stone was not known in half the cases operated upon and the difficulties that lie in the way of diagnosis show that suprapubic cystotomy and exploration should be performed in all cases of cystitis that become

chronic and are rebellious to treatment. W. B. Clarke (Brit. Med. Jour., May 13, '99).

While a stone may exist in a bladder for a long period, without giving rise to much irritation, sooner or later there will be cystitis, and probably infection of the kidneys; so that, if the patient's health will at all permit, a vesical calculus should be removed as soon as possible after its presence has been detected.

**Treatment.** — Efforts to dissolve the stone in the bladder either by internal medication or by irrigation are not to be recommended. There are two methods available for the removal of stone in the bladder, namely: litholapaxy and lithotomy.

*Litholapaxy* is the operation to be recommended in the vast majority of cases. The exceptions to this advice at the present time are few. In children below four years of age, however, it is usually impossible to introduce an evacuating catheter of sufficient size to carry out the fragments. Above this age, however, with proper instruments, litholapaxy is just as safe and satisfactory as in the adult. If the patient has a stricture of the urethra it will usually be possible to treat this preparatory to operating for the stone. Occasionally the presence of hypertrophy of the prostate will interfere with the introduction of the lithotrite or the evacuating tubes, and thus prohibit this operation. In suitable cases White recommends the operation of vasectomy or castration, according to the conditions present, and after the prostate has undergone sufficient atrophy to proceed with the litholapaxy.

Cystitis does not constitute a contraindication to the crushing operation, as it can be treated beforehand by urinary antiseptics internally and bladder irrigations.

The advantages of litholapaxy are its safety, in experienced hands; the avoidance of a wound, and the short convalescence, uncomplicated cases being able to leave the house in from two to five days after the operation. In contradistinction to this a cutting operation confines the patient to bed for some weeks, and there is always some danger of a urinary fistula remaining.

From a study of the results personally obtained in 133 operations for stone, it has been found that not more than 3 per cent. of cases should be unsuitable for litholapaxy. The cases that are unsuitable may be tabulated as follows:—

1. Those with such condition of the passages that the lithotrite necessary for crushing the stone cannot be passed.

2. The stone may be so large that the largest lithotrite will not lock on it; or it may be so hard that it will resist the greatest force that the instrument will bear or the operator be able to exert.

3. A stone in the bladder may be complicated with one or more in the membranous or prostatic portions of the urethra, which cannot be pushed back into the bladder; or the stone may be encysted, or may be complicated with a tumor of the bladder.

4. A state of affairs may exist that makes it desirable to establish complete drainage and rest the bladder after removal of the stone, such as extensive cystitis with ammoniacal urine, and especially if associated with stricture of the urethra.

5. Such a condition of irritability of the bladder that the organ will retain no fluids even under profound anæsthesia. The stone being clasped by its hypertrophied walls in this latter case, an expert might perform litholapaxy without increasing the patient's risk; but perineal lithotomy would have considerable advantages in such cases in allowing drainage and rest to the bladder.

Of the cutting operations, the perineal method is preferred, the suprapubic being restricted to the following conditions: (a) exceptionally large calculi, and these



would probably be better dealt with by perineal lithotripsy; (b) encysted calculi; (c) those associated with tumor of the bladder, which it is advisable to remove at the same time. Cunningham (Brit. Med. Jour., Aug. 7, '97).

Litholapaxy is certainly the operation of election in all simple cases of stone in the urinary bladder. When the stone is too hard or too large to be crushed through the urethra or removed by the lateral method without injury, the suprapubic method should be adopted or, perhaps better, by perineal lithotripsy. When the stone is encysted or associated with a tumor of the bladder or prostate, the suprapubic route should be chosen and both removed at the same time. Where there is a tight, deep urethral stricture, especially when fistulae exist, requiring a long operation to overcome, the suprapubic or median perineal operation should be selected.

In ankylosis of one or both hip joints, which interferes with the use of urethral instruments, and excludes all perineal operations, suprapubic lithotomy should be done. In the presence of foreign bodies in the bladder, which may form the nucleus of a calculus and resist the lithotrite, one of the perineal methods should be performed.

Although litholapaxy applied to children is very successful in the hands of experts, for the present lateral lithotomy is the safer operation for the general surgeon.

Litholapaxy should be carried out, whenever possible, when senile degenerations exist, or when there are morbid changes in the genito-urinary apparatus, and the necessary treatment afforded to the complication, either before or after litholapaxy. C. B. Shuttleworth (Canadian Practitioner and Review, July, 1904).

*Lithotomy.*—Cases will occur, however, in which the crushing operation is inappropriate. In addition to the contraindications already mentioned, if it is suspected that the nucleus of the stone is a foreign body of any kind, introduced into the bladder by accident or other-

wise, it will be necessary to perform lithotomy. In rare instances also it will be impossible to crush the stone either on account of its hardness or its large size.

In cutting for stone the surgeon may approach the bladder either by the suprapubic route or through the perineum. For the removal of stones more than an inch and a half in diameter and for inspecting the bladder if any such indication exists, the suprapubic method should be selected. For the removal of smaller calculi many surgeons prefer the perineal incision. Others, however, prefer to open the bladder above the pubes in every case in which it is necessary to do a cutting operation. If the bladder-walls are healthy, it will be possible in many cases to unite the bladder incision by sutures in the suprapubic operation, and thus overcome one of the serious objections to lithotomy.

Before subjecting a patient to any operation for stone in the bladder it is very desirable to administer a urinary antiseptic for a few days; either salol or boric acid in doses of 10 grains three or four times a day will meet the requirements. Urotropin or cystogen, a combination of ammonia and formalin, also seems to be an efficient and powerful agent. The dose is from 20 to 30 grains in twenty-four hours. In cases complicated by marked cystitis it would also be advisable to practice irrigation of the bladder two or three times daily for a few days before operation. This is particularly to be advised if litholapaxy has been decided upon. The restriction of the diet to milk chiefly and more or less absolute rest for a few days will also add to the success of the operation. As in all cases in which ether is to be ad-

ministered, it is desirable to administer a purgative the day preceding the operation and to withhold all food for at least six or eight hours before administering the anæsthetic. If a cutting operation is proposed, the parts should be cleanly shaved and prepared according to the orthodox methods of carrying out antiseptic operations. All of the instruments and other articles to be used in the operation should be as carefully sterilized as for any other operation.

LITHOLAPAXY.—The instruments required for this operation are a lithotrite, evacuator, evacuating catheters, ordinary catheters of different kinds, a vesical sound, warm boric-acid solution, syringe for irrigating the bladder, and suitable receptacles. A basin or jar with three or four thicknesses of gauze secured over the top should be prepared to receive the stone. It should also be the rule to have at hand the necessary instruments for lithotomy in the event that the attempt to crush the stone should fail for any reason. It has also happened that the blades of the lithotrite became jammed when separated so that it was absolutely impossible to withdraw the instrument and it was necessary to do a suprapubic operation at once for the purpose of sawing off the blades, above the curve that removal might be accomplished.

There are a number of lithotrites upon the market, the two chief forms being those of Bigelow and of Weiss. Either will be found entirely satisfactory. For operating upon children a special instrument has been designed by Weiss. Of the various forms of evacuators, that designed by Bigelow is perhaps the most satisfactory. It should be fitted with several evacuating catheters of different sizes.

Ether having been administered, the first step should always be the introduc-

tion of the stone-searcher in order to be certain that the stone is still in the bladder. Unless the surgeon can demonstrate its presence by sound to at least one person besides himself, it should be the rule to abandon the operation and allow the patient to come out of the influence of ether. In such an event, subsequent examinations may be made and the future course decided accordingly. If the stone has been detected, however, the next step should be to introduce a suitable catheter properly lubricated and withdraw the urine. The bladder should then be irrigated with warm boric-acid solution—10 to 15 grains to the ounce of sterile water—until the fluid returns clear. A quantity of the solution should then be introduced into the bladder and allowed to remain, the catheter being withdrawn. In the adult this quantity may be about 6 fluidounces; for a child 2 or 3 ounces will be sufficient. The patient should be in the supine position, with the legs extended, but slightly separated. The lithotrite is then lubricated and carefully introduced into the bladder. A surgeon who is right-handed may introduce the lithotrite while standing to the patient's left, but he should then pass to the right side of the patient for the subsequent manipulations. The instrument, having been introduced, should be moved back and forth slightly to see that it is free, and the beak then turned toward the base of the bladder. The ratchet which binds the two blades should be released and the jaws separated one or two inches and again brought together. If the stone is not caught between the jaws the manipulation is to be repeated, shifting the points in order to sweep the different portions of the base of the bladder. When the stone is caught, the blades are to be held firmly together and locked, after which the



instrument is revolved until the beak points anteriorly, when the stone is crushed by screwing down the handle. The blades are then released, turned again toward the base of the bladder, another fragment picked up, turned forward, and crushed as before. This procedure is continued until the instrument fails to seize any fragments too large to be withdrawn through the evacuating tube. The blades of the instrument are then tightly closed and locked, after which it is withdrawn. The largest evacuating catheter that will pass easily should then be introduced, care being taken to prevent any of the fluid from escaping from the bladder, and the evacuator—previously filled with warm boric-acid solution—attached. By alternately compressing and relaxing the bulb the fragments will be drawn into the latter and will fall into the glass receptacle below. This manipulation should be continued until no further fragments are brought out. If there is sufficient bleeding from the mucous membrane of the bladder to color the boric solution deeply, the bulb may be emptied and refilled, the stop-cock on the outer end of the catheter being closed in the meantime to prevent the escape of the fluid. If during the evacuation of the fragments a click is repeatedly heard as the bulb is relaxed, it will indicate that a fragment remains which is too large to pass through the eye of the catheter, and the lithotrite will have to be reintroduced in order to reduce this. After the bladder appears to be empty of fragments the stone-searcher should be again introduced, and if any portion of the stone remains it should be crushed and removed. It is undesirable, however, to reintroduce the lithotrite oftener than is absolutely necessary; so that the crushing process should be very carefully

carried out and as far as can be determined fully accomplished before withdrawing the instrument. When the operation is completed the bladder should again be irrigated with warm boric-acid solution until the fluid which returns is clear, when 2 or 3 ounces may be introduced and allowed to remain. The patient is then returned to his bed, and, if the operation has been a long one, external heat applied and hot compresses placed over the hypogastrium. The urinary antiseptic should be continued and the diet restricted to milk for two or three days, until it is evident that the convalescence is assured. Patients otherwise healthy and who do well may be allowed out of bed on the second or third day.

LITHOTOMY.—Cases inappropriate for litholapaxy will have to be subjected to one of the forms of lithotomy. In general it may be stated that in adults the perineal route should be selected under the following circumstances: 1. In cases of deep urethral stricture rebellious to dilatation, in which, by selecting the median method, the stricture may be divided at the same time. 2. In cases of stone of moderate size and of such hardness and density as to make too great demands on the strength of the lithotrite or of the operator. This condition occurs very rarely. 3. In cases of atony of the bladder where there is little or no expulsive power, where there is already a chronic cystitis, and where the stone is of medium size.

Suprapubic lithotomy should be selected: (1) when the stone is an unusually large one, and at the same time is believed to be of exceptional hardness; (2) in cases of marked prostatic hypertrophy with pouched bladder, chronic cystitis, and large stone; and (3) sometimes when the kidneys are diseased. In

children, too young to permit of the introduction of the instruments necessary to perform litholapaxy, the lateral perineal operation would be the method of choice.

**PERINEAL LITHOTOMY (LATERAL).—**The instruments required for this operation are a grooved staff, lithotomy-knife, probe-pointed bistoury, lithotomy-forceps, lithotomy-scoop, a large-sized pure-rubber catheter, a catheter *en chemise*, hæmostatic forceps, scissors, ligatures, and sutures.

The patient having been etherized, the vesical sound is introduced, and if the stone is detected the operation is proceeded with. The urine is withdrawn, the bladder irrigated with warm boric-acid solution, after which 6 or 8 fluidounces are allowed to remain. The patient is then so arranged that the buttocks project slightly from the end of the table; the thighs are flexed upon the abdomen and the legs upon the thighs and retained in this position by assistants. The grooved staff is then introduced and placed in proper position by the surgeon, after which it is held by an assistant whose duty it is to accurately retain it in this position. The handle should be held either perpendicularly or inclined slightly toward the patient's right groin, and should be drawn well upward so that the curve rests against the under surface of the symphysis pubis. The surgeon should then fix in his mind the central point of the perineum, which is midway between the anus and the perineo-scrotal junction, and in the adult is about an inch and a half in front of the former. Finally observing that the staff remains in proper position, a lithotomy-knife is introduced vertically in the direction of the staff at the central point of the perineum and just to the left of the raphé and carried downward and

outward across the left ischio-rectal space, terminating on a line between the anus and the left ischial tuberosity and rather nearer to the latter than the former. This incision is deepest at the beginning and becomes shallower at the posterior extremity. It passes through the skin, superficial fascia, transverse perineal muscle, nerve, and vessels, the lower edge of the anterior layer of the triangular ligament, and the inferior hæmorrhoidal vessels and nerves.

The surgeon then introduces the left index finger into the wound, and locates the groove of the staff. The knife is now passed along the finger and made to engage in the groove, after which it is pushed along toward the bladder, being careful not to allow it to escape from the guide until the gush of fluid indicates that the bladder has been reached, when it is made to cut downward and outward in the line of the first incision. This divides the membranous and prostatic portions of the urethra, the compressor-urethræ muscle, the posterior layer of the triangular ligament, a few fibres of the levator-ani muscle, and the left lobe of the prostate. The left forefinger should then be introduced into the bladder, using the staff as a guide, and when the stone is felt the staff should be withdrawn, the lithotomy-forceps introduced along the finger and made to seize the calculus, which is then extracted.

In children in whom it is desirable to operate through as small an incision as possible, the lithotomy-forceps may be introduced along the groove of the staff and the stone extracted without introducing the finger at all. Little difficulty is experienced in finding the stone in children, inasmuch as there is no pouching of the bladder. Occasionally it will be found that the stone is too large to extract through the incision, in which



case it may be broken into two or more fragments by means of a lithotrite introduced through the wound. It is desirable, however, to extract a stone without fragmentation when possible; but this should not be done at the risk of injuring important neighboring structures. Finally the bladder should be explored in order to make sure that other calculi do not exist, the wound is inspected for any bleeding vessels that should be tied, a large rubber catheter introduced, the bladder irrigated, and a little iodoform gauze laid in the superficial portion of the wound around the catheter,—which should be held in place by sewing to the edge of the incision,—and a dressing applied. Usually the hæmorrhage which follows the incision subsides after the patient's legs are brought together. If any pronounced bleeding continues from the deep portion of the wound, it is best controlled by introducing a catheter *en chemise*, which is made by introducing the end of a large rubber catheter for about two inches through the centre of four layers of sterile gauze about eight inches square and fixing the gauze in this position by tying firmly with a silk thread. This is then introduced into the wound and gauze packing placed firmly and evenly around the catheter and inside of the gauze.

Occasionally when the artery of the bulb has been divided, the hæmorrhage will be so free as to demand a ligature or the application of pressure-forceps, which may be allowed to remain one or two days. The internal pudic artery has been wounded by carrying the incision too far outward toward the tuberosity of the ischium. Bleeding from this source may be arrested in the same manner. The rectum has also been wounded by carrying the incision too far inward and by failing to keep the blade of the

knife sufficiently lateralized; usually the wound in the rectum heals spontaneously.

Median lithotomy is performed by means of an incision directly in the middle line of the perineum. The patient is placed in the same position as for lateral lithotomy, the staff introduced and held vertically and drawn well up under the pubes. The left index finger of the surgeon is introduced into the rectum and the groove of the staff located at the apex of the prostate. A knife with a double cutting edge at the point and a cutting edge of about three inches on one side is introduced with the long cutting surface upward an inch in front of the anus and directed to the groove in the staff at the point located by the finger. When the point of the knife has reached the groove of the staff, it is pushed onward toward the bladder so as to incise the apex of the prostate and then withdrawn, cutting upward for from three-quarters of an inch to an inch. A probe-pointed grooved director may then be passed into the bladder on the groove of the staff, to be used as a guide for the introduction of the finger or of the lithotomy-forceps. As this operation is made in the middle line, there is comparatively little hæmorrhage; still, on the other hand, it provides but very limited space in which to work, and is therefore suitable for removing calculi of the smallest size only. The incision also approaches very closely to the bulb anteriorly and to the rectum posteriorly, either of which may be injured if the knife is carried slightly beyond the limits mentioned.

In a series of 206 operations done in India for stone, lithotrity was used in 153 males and lithotomy in 36. The stone was never found too hard to crush. Forty-eight of the cases were in boys under 10 years of age, and 15 were

in boys under 3 years of age. One death occurred in a boy  $3\frac{1}{3}$  years of age. Great advantage was derived from the introduction of a drachm of oil into the urethra prior to the passage of the instrument and in young boys the crevices of the crushing instrument were filled with soap before introduction to avoid scratching the mucous membrane. When the instrument cannot be readily and easily passed, lithotomy had better be resorted to. Three deaths occurred out of 36 cases of lithotomy and three out of 161 cases of crushing, 2 of which could hardly be attributed to the operation. W. F. Adams (Brit. Med. Jour., May 25, 1901).

**SUPRAPUBIC LITHOTOMY.**—The instruments required for this operation are scalpels, dissecting-forceps, hæmostats, retractors, rectal bag, lithotomy-forceps, lithotomy-scoop, catheters, syringe, stone-searcher, scissors, needles, sutures, etc.

The preparation of the patient has already been described. After anæsthesia the presence of the stone should be determined before proceeding. The next step should be the introduction of the rectal bag, previously oiled, well above the internal sphincter. A catheter is then introduced, the urine withdrawn, and the bladder irrigated with warm boric-acid solution, after which from 6 to 10 ounces are allowed to remain. A catheter or rubber tube should be tied around the penis in order to avoid expulsion of the solution. From 8 to 10 ounces of boric solution should then be injected into the rectal bag and retained. In operating in children the quantities of fluid both in the bladder and in the rectal bag should be very much smaller, and, owing to the higher position of the bladder at this time of life, the rectal bag may be dispensed with altogether. The incision should begin in the middle line about half an inch below the symphysis pubis and in the adult may be

carried upward about three inches. The incision is carefully deepened, either between the muscles or through them, until the transversalis fascia is reached. When this is divided the prevesical fat and connective tissue are exposed. It is desirable to reach the bladder by blunt dissection from this point, pushing upward the fat and connective tissue, which frequently contain a number of large veins, with the finger and handle of the scalpel; this procedure also raises the peritoneum out of danger. It should always be borne in mind that the peritoneal reflexion may be abnormally low in any case, and that it may be opened if due caution is not observed.

After the bladder has been exposed all bleeding should be controlled by pressure-forceps, the bladder-wall trans-fixed with a sharp hook, and a scalpel thrust vertically into the bladder, cutting downward toward the symphysis. The edges of the bladder-opening may then be caught with tenacula or trans-fixed with needles carrying strong silk threads. The forefinger may then be introduced, and the stone located and removed by the forceps. After being certain that the bladder is empty, if the walls are in a healthy condition, the incision may be united by chromicized cat-gut sutures. They should be passed close together and should include all of the coats except the mucous membrane. The abdominal wound is to be united by suturing, a small drainage-tube being introduced through the external wound and retained until it is certain that the incision in the bladder is going to heal kindly. A catheter should be introduced through the urethra and retained for a week or ten days.

If the bladder-walls are unhealthy, or if there is a pronounced cystitis so that immediate suture is unsafe, the margins



of the bladder-wound may be united by a few stitches to the deeper portion of the abdominal incision and a large drainage-tube introduced. The use of siphon-drainage is very desirable in preventing the urine from saturating the dressings and excoriating the patient's skin. The bladder should be frequently irrigated and the skin around the wound cleansed and protected by an antiseptic ointment. As soon as the condition will permit, the external drainage should be removed and the wound allowed to close.

For bladder drainage after suprapubic cystotomy the tubing and clamp of what is known as a fountain-syringe may be used. This comprises a bag to contain water and two pieces of rubber tube joined at a right angle. The upper end of the longer limb of the T-shaped tube is held vertically, and fixed to the bag; the shorter placed horizontally, and connected with a soft catheter in the bladder. The clamp is fixed so that it is all but occluded close below the irrigator-bag. The S-shaped tube of the outlet of Cathcart's arrangement is replaced by a simple hitch-knot tied loosely in the rubber-tube. One or two drops per second from the irrigator prevent the bladder from filling, so that it is not necessary to replenish the bag of the fountain-syringe oftener than once in several hours. It makes no difference in the working of the apparatus whether the bag is hung above the patient or lower. The catheter in the bladder should have a second opening made into it opposite the original one, to prevent blocking by a piece of mucous membrane being sucked in. Dawbarn (N. Y. Med. Rec., May 30, '96).

The suprapubic operation, even though the stone be large, is not to be compared to the vaginal route when this canal is fully developed, as in the adult female, especially in cases of married women. In the suprapubic operation there is no natural drainage. The urine must be retained in a bladder already inflamed, where it acts as a still further irritant, or must drain out through the abdominal wound at the risk of urinary infiltration

and of setting up inflammatory action in the site of the wound. In the vesico-vaginal route the urine flows out constantly at first, allowing no new irritation of the inflamed lining of the bladder and permitting a free and ready escape of urine, pus, mucus, and any remaining portion of the calculus. T. J. Happel (Phila. Med. Jour., Apr. 29, '99).

### Vesical Tuberculosis.

The majority of cases of tuberculosis of the bladder occur before the fortieth year. It is usually secondary to deposits elsewhere. In a small proportion of cases the disease seems to be primary in the bladder. Many of the secondary cases follow tuberculosis of the kidney or an ascending infection from the epididymis. More rarely there is a direct extension from the prostate or seminal vesicles.

**Symptoms.**—The symptoms of tuberculosis of the bladder develop insidiously and are so slight in the early stages that advice is rarely sought until the disease has lasted for some time. The earliest manifestation observed by the patient in most cases is increased frequency of urination. Pain usually follows sooner or later. It is mild in some cases and severe in others, depending upon the location of the disease. Deposits at the neck of the bladder always give rise to considerable pain. Pus and blood are invariably present in the urine, the quantity varying in different cases, and at different times in the same case. These are merely the result of the ulcerating process, and not of the tuberculosis *per se*. Cystitis develops sooner or later, when the symptoms are much more pronounced, the pain, frequency of urination, and tenesmus all being much increased.

There is nothing peculiar about the symptomatology of vesical tuberculosis. The diagnosis must rest upon the detec-

tion of tubercle bacilli in the urine of a person who has the symptoms of chronic cystitis. If bacilli are found, however, we are unable, in many cases, to determine whether they emanate from a focus of disease in the kidney or in the bladder. On the other hand, bacilli are not detected in some cases of genuine vesical tuberculosis. It is quite possible to have tuberculosis of the kidney in conjunction with a non-tubercular cystitis. The diagnosis will usually be made first by excluding the common causes of cystitis—namely: gonorrhœa, vesical calculus, stricture of the urethra, and hypertrophied prostate—by the usual methods of detecting these conditions; and, secondly, by meeting with the evidences of marked cystitis with tubercle bacilli in the urine and without any symptoms referable to the kidney. A tubercular family history or the presence of a tubercular lesion elsewhere in the patient would point to a similar condition in the bladder. In looking for the presence of tubercle bacilli repeated examinations should be made before deciding that they are absent. Finally cystoscopical examination may yield valuable evidence, either by showing the presence of a tuberculous process or by establishing the absence of such a condition. If no cause can be found in the bladder it would be well to catheterize the ureters separately in order to locate the seat of the disease.

**TREATMENT.**—In the early stages the patient should be surrounded by the most favorable hygienic conditions; if it is possible to build his health up by forced feeding, suitable climate, etc., the disease may be arrested and healing follow. The urine should be kept as healthy as possible by the administration of a urinary antiseptic and by the use of milk and water in liberal quantities. In the pres-

ence of a pronounced cystitis, the proper treatment for this condition should be instituted. Among the drugs employed in the local treatment, iodoform occupies a prominent place. The introduction of a small quantity of a 10-per-cent. mixture in sterilized olive-oil or glycerin every few days should be tried. The bladder should first be thoroughly irrigated in order to prepare for the iodoform, and, if any evidences of irritation follow the treatment, it should not be repeated until this has subsided. Irrigations of bichloride of mercury, beginning with 1 part in 5000, is highly extolled by Guyon. It does not seem certain, however, that this could have any specific effect on the tuberculous process, and it is a question whether this treatment does more than to relieve the accompanying cystitis. For severe pain, tenesmus, and frequency of urination, suppositories of opium and belladonna may be necessary.

When the pain and frequency of urination become unbearable and fail to respond to treatment, it will be necessary to perform suprapubic cystotomy for the purpose of drainage; at the same time it may be possible to remove it, if superficial, by means of a curette. The rest afforded by prolonged drainage of the bladder is one of the most potent factors in aiding to bring about a cure. It is always a difficult matter to decide when the suprapubic opening may be allowed to close in cases that progress favorably. In general, this should not be until the evidences of cystitis have disappeared.

If tuberculous lesions of the genito-urinary tract exist, their operative removal is sometimes followed by improvement, and cure of the process in the bladder, provided the patients are placed under the most favorable hygienic surroundings. Operative treatment of the blad-



der alone in the presence of tuberculous lesions of other portions of the urinary tract is usually harmful rather than beneficial. The local treatment of the tuberculous bladder by means of injections or applications through the urethra is generally useless and often very deleterious. The internal administration of the drugs known as urinary antiseptics is generally useless. Palliative operations, such as suprapubic drainage, may be useful in advanced cases. The general or hygienic treatment, suitable climate, out-of-door life, etc., offer these patients the best hope of recovery. Such hygienic measures should be preceded by the operative removal of tuberculous foci in the kidney, the epididymis, the prostate, and the seminal vesicles, if such exist, and the patient is still in sufficiently good condition to bear the operative procedure. In those rare cases where the bladder alone is affected over a moderate area only, the operative removal or destruction of the diseased tissue may be followed by improvement and even cure. A. B. Johnson (*Medical News*, May 14, 1904).

### Epispadias.

Epispadias, or absence of the roof of the urethra, is occasionally met with. It may be either complete or partial. The partial variety shows absence of the roof of a portion of the urethra. In the complete variety the entire roof of the urethra is absent and there is also exstrophy or absence of the anterior wall of the bladder and the overlying portions of the abdominal wall; so that the mucous membrane of the posterior wall of the bladder presents in the hypogastric region. In the latter condition there is, of course, complete incontinence of urine.

**Treatment.** — In the partial forms of epispadias of sufficient extent to demand relief it is proper to advise closure of the defect by operation. If there is plenty of material the edges may be freshened and brought together over a catheter

by means of sutures. If this method is not available, a flap may be taken from the anterior abdominal wall and turned downward to form the new roof of the urethra.

Thiersch's operation is performed in four stages. The first is the formation of that portion of the canal which normally is situated in the glans. An incision is made on either side of the median furrow through about three-fourths of the thickness of the glans. The central portion is depressed, while the two lateral portions are freshened and brought together over a short piece of catheter or rubber tubing.

The second stage is the formation of the remainder of the roof of the urethra. For this purpose two flaps are made from the integument on the dorsum of the penis. In length these flaps correspond to the amount of the defect in the urethra. The base of one flap corresponds to the margin of the urethral groove, while the free edges of the other flap correspond to the opposite margin of the groove. A catheter is now introduced into the bladder and made to lie in the urethral groove. The flap with its base next to the catheter is turned over the latter so that its raw surface is outward, while the free edge is held by transfix sutures armed with a needle at either end which transfix the base of the second flap. The latter is intended to cover over the raw surfaces presented by inverting the first.

The third step aims to close the small space between the two previous operations. For this purpose the prepuce is incised transversely and the glans slipped through this incision. The margins of the defect are next freshened, the prepuce made to cover this, and the raw edges sutured to close the opening.

Fourth step: This consists in the closure of the space which still exists between the posterior portion of the new urethra and the orifice leading to the bladder. For this purpose a triangular flap is made, the base of which is placed to the left of the normal urethral orifice. This flap is inverted so that the raw surface is uppermost. A second quadrilateral flap with its base in the inguinal region is made to cover the inverted first flap, and the wound closed by sutures.

A sufficient period of time should be allowed between each of these steps for perfect healing.

Method of treating epispadias which has personally given good result. The operation consists in refreshing the edges of the penile furrow, extending it till the abdominal parietes are reached, then excising two parallel strips of skin corresponding in size to the freshened penile portion. Bringing the penis on the abdomen, the denuded portions come in contact, and the penis is sutured in place, the penile furrow being converted into a urethra running from below upward. A second act, at a later period, consists in dissecting the penis out of its new bed, and with it a strip of skin of the proper size continuous with the glans and divided in the direction of the umbilicus. This flap is now turned down and the two raw surfaces united to each other. Rosenberger (*Beit. z. klin. Chir.*, B. 15, H. 3, p. 735).

The method of operating for exstrophy of the bladder is described under that heading.

### **Hypospadias.**

This is a congenital defect in which the floor of the urethra is absent. It is usually associated with curvature of the penis, the normal position of the urethra being represented by a fibrous band which has contracted, curving the organ downward. The deficiency may affect a very small or a large portion of the length of the urethra. Thus,

the canal may terminate at any point between the normal position of the external meatus and the perineum. The different forms are classified according to the position of the orifice of the urethra into: (1) balanic, those terminating at the base of the glans; (2) penile, those terminating at any point along the pendulous urethra; (3) perineal, those terminating at some point in the perineum.

The cause of hypospadias is arrest of development. The diagnosis is readily made upon inspection. The patient is led to consult the surgeon on account of the abnormal point of exit of the urine.

**Treatment.**—It is usually unnecessary to interfere in cases of the balanic variety, inasmuch as the normal functions are not greatly interfered with.

Instead of forming a new urethra in balanic hypospadias, the existing one may be dissected free and extended so as to make it do the service of a new canal. First, a transverse incision is made across the lower surface of the glans, which embraces the hypospadiac opening. By pulling the lower wound margin downward, the urethra can be exposed and separated from its surrounding tissue without being injured. Then, after a longitudinal incision has been made alongside the median line of the groove, by dissecting the edges of the groove, two flaps are to be formed and cut off in order to give a freshened surface. Now the hypospadiac orifice of the urethra is drawn forward and sutured to the initial point of these freshened margins of the groove, and opposite to it another suture is introduced in the same manner. If, now, the posterior portion of the displaced urethra is slightly inverted in its longitudinal direction, the retracted margins of the integument are pulled together and united above the urethra. The shape of the wound, which at first was transverse, now becomes longitudinal, forming a support for the urethra, which is thus kept straight at the same time. The creation of a new channel not having been necessary, the insertion of a tube will be use-



less. Carl Beck (N. Y. Med. Jour., Jan. 29, '98).

A new operation for hypospadias of the glans penis as performed by Bardenheuer is as follows:—

The skin on the lower surface of the penis above the glans is dissected back and the urethra freed by dissection from the spongiosa for such a distance that it can be readily carried to the end of the penis. The gland is then perforated by a trocar, where the urethra should pass; the freed urethra is drawn through this canal and stitched in position. The skin is then united by a sufficient number of sutures.

The after-treatment consists in the employment of boric-acid ointment, frequently removed. The stitches are removed on the eighth to the fourteenth day. Breuer (Cent. f. Chir., Nov. 5, '98).

The operation for glandular hypospadias personally recommended is as follows:—

The urethral orifice, together with its corpus spongiosum, is freed from its surroundings, the dissection being carried well backward. The glans is tunneled through, and the urethra is pulled forward, and the meatus is sewn to the external surface. The advantages claimed for the operation are:—

1. It does away with the necessity of operating in several sittings.

2. It insures greater certainty of union, other methods frequently requiring repetition of the operation and secondary measures for closure of fistulæ.

3. As there is an absence of any canal requiring to be covered over, a catheter *à demeure* is unnecessary. No subsequent constriction of the opening is to be apprehended.

4. The urethra remains surrounded by its corpus cavernosum, and the new external orifice by erectile tissue in a nearly normal fashion,—the latter circumstance being highly desirable for the proper ejaculation of semen. Von Hacker (Beit. z. klin. Chir., B. 22, H. 1, '99).

Over one hundred cases collected in which marriage proved fruitless. It is more common than is usually credited. In the French army it occurs once in every three hundred recruits. The neg-

lect of these cases in childhood is reprehensible. When operating on infants great care must be used in the dissection of the urethra. Carl Beck (N. Y. Med. Jour., Dec. 8, 1900).

In the other cases the treatment consists in straightening the organ and the formation of a canal in the normal position of the urethra. The straightening of the organ is accomplished by making one or more transverse incisions through the skin and any bands of tissue which tend to hold the organ in the abnormal position. It is occasionally necessary to carry the incision into the corpora cavernosa. The incisions should be united by sutures in a longitudinal direction.

According to Duplay's method, the subsequent steps are as follow: Second stage, the formation of a new meatus. If there is a well-marked depression through the glans, the free edges may be freshened, a small catheter laid in the groove, and the raw surfaces brought together and held in place by sutures or harelip-pins. This may be done at the same time that the organ is straightened, which will shorten the treatment. Third stage, the formation of a new canal. This should not be undertaken until some months after the organ has been straightened or until it is certain that the first operation has been successful. In carrying out the operation a catheter should be introduced through the canal forming the glans and passed into the bladder. It should lie in the groove representing the undeveloped urethra. An incision is then made parallel with and a little external to the catheter on either side, and the flaps dissected up somewhat, but not enough to cut off the blood-supply at the base. These flaps are then made to fold over the catheter, and are united with fine catgut sutures. It is not essential that the flaps should join. The skin external to the two in-

cisions should then be dissected up freely on each side, and the two flaps united in the middle line by fine mattress-sutures. Great care should be taken to keep the wound dry and prevent infection, as this would interfere with the success of the operation. The fourth step consists in joining the new canal at either extremity. The margins of the openings are freshened and the raw edges united by fine sutures over a catheter. It is not to be undertaken until the healing from the last step is complete.

According to the method of Anger, the third step is carried out by forming two flaps the length of which corresponds to the defect to be corrected. One flap has its base along one side of the urethral groove, and the other has its free margin along the opposite side of the groove. The flap with the base next to the groove is turned over the catheter and the free margin united to the base of the second flap by means of sutures armed with a needle on either end. The second flap is then drawn over the first and united to the skin-incision on the opposite side.

In some cases it will be found advisable to make use of the redundant prepuce. For this purpose an incision is made through both layers on the dorsum corresponding with the corona. The glans is slipped through this incision, and the mucous membrane separated from the cutaneous surface from the incision toward the free border, and the raw surface thus formed made to cover over that which resulted from turning flaps over a catheter to form a new urethra.

Case of peno-scrotal hypospadias in which Nové-Josserand's operation was used. The glans was imperforate; the urethra opened on the inferior aspect of the penis, at the junction of the latter with the scrotum. The glans being put

on the stretch, a long, narrow bistoury was pushed into its centre, in the situation of the dimple where the urethra should have opened; the knife was made to traverse the whole length of the penis, approximately in the line of the septum between the corpora cavernosa, and was made to emerge at the fistulous opening at the root of the organ; a tunnel was thus made in the position of the urethra. The knife was then withdrawn, and the bleeding was arrested by pressure with the fingers. Meanwhile a Thiersch graft was cut from the inner surface of the left upper arm, ten centimetres in length and two centimetres in width; the graft was then wrapped around an oiled bougie, with its raw surface exposed and fastened to the bougie by a catgut thread at either end. The bleeding from the wound in the penis having ceased, the bougie enveloped by the graft was inserted into the tunnel already made, so that one end projected from the opening in the glans and the other from the fistula at the root of the penis; the excess of bougie was cut off with scissors, the catgut thread at the anterior end of the graft was divided, and the circular edge of the tubular graft was stitched to the edges of the wound in the glans; *i.e.*, the site of the future meatus. A catheter was secured in the bladder and emerged at the fistula at the peno-scrotal junction, and through it all the urine escaped. On the third day the bougie was carefully withdrawn by the meatus, after cutting the catgut thread round the graft at its posterior end; the catheter was allowed to remain until the seventh day; thereafter the patient urinated by the fistula. On the tenth day the new urethra was dilated with bougies Nos. 15 and 16 (French scale); this was repeated every second day until a No. 19 was easily passed. At a later period the fistulous opening was closed by a plastic operation, and the patient then urinated by the meatus in the natural way. On separating the lips of the meatus, one could see the white epidermis lining the canal of the urethra. Tuffier (*Ann. d. Mal. d. Org. Gen.-Urin.*, Apr., '99).

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**URTICARIA (HIVES; NETTLE-RASH).**

**Definition.**—A symptomatic disorder of the skin characterized by the sudden appearance of pinkish, hard, puffy swellings, or wheals, usually pinkish-white, but varying greatly in color and shape.

**Symptoms.**—The wheals are invariably accompanied by local heat, marked pruritus, and formication, and disappear early. Its fugitive character is pathognomonic. The size and form of the wheals vary greatly, and successive crops may appear in various parts of the body. They may vary from the size of a ten-cent piece to that of a silver dollar. In typical cases they are round or oval or appear as streaks or irregular patches. The intensity of the subjective symptoms does not always correspond to the degree of eruption, and these may continue quite awhile after the disappearance of the skin-lesion. Again, the symptoms may be irregular, the itching preponderating at times, the burning at others, etc. The rash may appear at one spot, disappear, then suddenly appear all over the body; again, it may develop slowly. The mucous membrane of the mouth, pharynx, larynx, œsophagus, and vulva may be involved. In the larynx œdema may ensue and cause dangerous symptoms.

Case of pharyngeal urticaria seen in a young lady, in whom sudden severe dyspnœa occurred while attempting to sing. In about ten minutes the eruption or urticarial wheals were noticed on the skin. A spray of antipyrine and cocaine to the throat gave immediate relief. J. M. Taylor (Phila. Med. Jour., Apr. 2, '98).

General malaise, pain in the legs, and fever have been observed in some cases. The scratching and rubbing to which the patient resorts greatly aggravate the symptoms and cause fresh wheals to ap-

pear. The duration of urticaria varies from a few hours to a few days; periods of remission are usual. The eruption, as a rule, leaves no trace, though slight œdema may persist for a few hours.

Besides the ordinary form just described, there are three varieties of urticaria: (a) acute febrile urticaria; (b) urticaria patulosa; (c) urticaria pigmentosa. *Acute febrile urticaria* is rarely met with. It appears suddenly; the eruption is red and attended by much swelling. The trunk, face, and limbs are the areas of predilection. It often develops in the mouth and throat and tends to cause dangerous laryngeal œdema. It greatly resembles scarlet fever. *Urticaria papulosa* is generally observed in children. It usually lasts a long time, even years, and is attended by remissions. The wheals are mixed with papules, and the itching and local irritation is exceedingly marked, especially at night. *Urticaria pigmentosa* differs from the other forms in being attended with a buff-colored pigmentation of the skin, patches resembling those observed in measles, or persistent tubercle-like prominences. Yellow patches persist after the active symptoms disappear. The itching, burning, etc., are only marked after scratching. It is early observed.

**Etiology.**—Urticaria is due, in most instances, to the ingestion of shell-fish, especially lobster, crab, clams, mussels, oysters, etc., but it may also be caused by ordinary articles of food—fish, pork, various fruits, especially strawberries, raspberries, and peaches—which irritate the gastro-intestinal tract and give rise to the rash through reflex action. Intestinal parasites often give rise to urticaria in children from this. Another class of cases is ascribable to the stings and bites of venomous insects, fleas, mosquitoes, etc., or the irritating substances

derived from jelly-fish, the Portuguese man-of-war so common in our Northern waters, caterpillars, and ants, and various dyes. The sting of nettle-hairs may also be included in this category. Many drugs—especially copaiba, cubebs, turpentine, quinine, and capsicum—may give rise to urticaria in persons that are unusually susceptible to their effects. It often attends other skin disorders, especially scabies, pityriasis, and eczema, mainly as a result of the scratching which intense pruritus renders practically unavoidable. Disorders of the genital tract, pregnancy, amenorrhœa, and constipation are frequent causes. Indeed, urticaria may occur as a symptom of almost any affection to which the human organism is liable. The rheumatic and gouty diathesis seem to predispose to it, or at least to be very closely associated with the appearance of urticarial wheals, or pomphi.

**Pathology.**—The development of a wheal is a process determined by a reflex mechanism set in motion by two sets of stimuli. Here, as elsewhere, the mechanism must consist of afferent nerves, a centre, and efferent nerves, the centre being located in the plexus of fine fibres ramified through the superficial layers of the corium. The stimuli which awaken the activity of this system are direct or indirect; they are external irritants applied directly to the surface of the skin,—*e.g.*, changes of temperature, nettles,—or they arise from the ingestion of certain substances endowed with toxic properties (Stephen Mackenzie). The wheal is a circumscribed swelling of the skin, attended with engorgement of the vascular supply and an exudation of serum into the cellular tissue around the vessels. The proximity to the absorbent vessels accounts for the early disappearance of the wheals. In the papular form the

papules are ascribed to urticarial exudation into the cuticular structures. Unna attributes the wheal to spasm of the venules whose functions are to carry off the lymph.

**Treatment.**—Urticaria being purely a symptomatic disorder, treatment should aim to correct the primary etiological factor. But a few of these have been enumerated even in the long list given under ETIOLOGY: a statement emphasizing the need of careful inquiry into each case. The environments of the patient, his underwear, should be submitted to close scrutiny; the state of his digestive, reproductive, and urinary organs should be inquired into; and the class and quality of his food investigated. Diathetic disorders—such as rheumatism and gout—demand special attention. As to the internal measures indicated for the eruption, atropine is considered valuable by Besnier; *strophanthus hispidus* by Rifat, who gives 10 to 20 drops daily; while iodide of potassium, arsenic, and quinine have also given excellent results in some cases.

The following mixture is highly recommended as a local application for urticaria:—

℞ Alcohol,  
Chloroform, of each, 3 parts.  
Sulphuric ether,  
Menthol, of each, 1 part.

M. To be applied in the form of spray. Gaucher (N. Y. Med. Jour., Apr. 9, '98).

The following simple lotion is of great value in allaying the burning and itching of urticaria:—

℞ Hamamelis-water, 2 ounces.  
Salt,  $\frac{1}{2}$  ounce.  
Enough distilled water to make 1 pint.

To be applied freely. Skinner (Brit. Jour. of Derm.; Phila. Med. Jour., Mar. 10, 1900).

Urticaria, produced by toxic foods, shell-fish, etc., is best met by lavage of



the stomach or an emetic. A cup of lukewarm water is often sufficient for the latter purpose. A saline purgative should follow. In neurotic and arthritic cases sodium bicarbonate is often efficacious, especially, according to Cerilly, if given per rectum. The injection should contain, for an adult, 5 drachms of the bicarbonate of sodium, 30 drops of the wine of opium, and 1 pint of boiled water. These are repeated several times a day.

B. Wolff (Amer. Medico-Surg. Bull., May 25, '98) relieves the most acute symptoms of urticaria within a few hours, and effects a cure within twenty-four hours, by giving sodium phosphate in doses of 4 to 5 grains every three hours, in concentrated solution.

The following solution may be used topically:—

℞ Prepared calamin, 45 grains.  
Zinc oxide, 45 grains.  
Carbolic acid, 15 grains.  
Lime-water, 1 ounce.  
Rose-water, 2 ounces.—M.

Bulkley (Med. Rev. of Rev., June 25, '98) recommends the following application as a calmative:—

℞ Chloral,  
Camphor, of each, 1 drachm.  
Pulv. starch,  $\frac{1}{2}$  ounce.

M. Sig.: Keep tightly corked in a wide-mouthed bottle. Rub in with the hand.

Fresh cocoanut-oil rubbed into the skin is of value. The fear of the oil spoiling one's clothes is groundless. The skin absorbs the oil; after two or three minutes' gentle rubbing the oil disappears, and one can rub himself with a towel without any coming off, unless, of course, a great excess has been applied; then the towel will remove the excess.

The best time to put it on is before going out for the evening's exercise. One should strip, pour a little of the oil into the palm of the hand, and rub

it over the body from the neck to the ankles. It is not advisable to use sponge or rag.

When coming in to dress for dinner, the bath is taken, no soap being used. There is no reason why the oil should not be used twice a day, if necessary, about a tablespoonful each time.

By adopting these simple means, many in Barrackpore have been saved from the inflictions of prickly heat during the hot seasons. R. R. H. Moore (Indian Med. Record, June 12, 1901).

### UTERINE ADNEXA, DISEASES OF. Malformations of the Ovaries and Tubes.

Malformations of the ovary and tube may be congenital or acquired. Both ovaries may be congenitally absent. This malformation is generally associated with defective development of the uterus. An individual so affected does not experience the physical changes in conformation incident to puberty, and more resembles the male. If one ovary is absent, the corresponding half of the uterus and tube will probably be deficient in development. The corresponding kidney has also been found absent. A third or accessory ovary is very infrequent. Constricted portions of the ovary have been mistaken for supernumerary ovaries. Small islands of ovarian tissue have been found upon the peritoneum. Such conditions, or an incomplete removal of an ovary, are undoubtedly the causes of menstruation subsequent to oöphorectomy. With absent or partially developed ovaries the sexual functions are never performed normally. The absence of one ovary or its destruction by disease constitutes no obstacle to either sexual intercourse or conception. It is very important to determine the absence or existence of rudimentary ovaries, as, when once recognized, the futility of measures to establish menstruation is demonstrated.

Defective development in the tubes consists generally in defective development of the fimbriæ at their abdominal ends. The tube may be unusually short or well developed on one side and rudimentary upon the other. The most frequent alteration is in the supernumerary ostia, or openings of the tube. These may be mere apertures or surrounded by fimbriæ. A defective development may result in an unusually convoluted tube. These convolutions may be so marked as to form strictures which contract the cavity sufficiently to render the woman sterile. In failure of the ovary to descend, the tube may be drawn out at the higher level.

#### **Acquired Malformations of the Ovaries and Tubes.**

The acquired malformations of the ovary and tube are frequently produced by disturbances in the circulation. They result in hyperæmia, or congestion, of the ovary. This occurs physiologically during ovulation and coition. It is not infrequent at the establishment of the menstrual function, especially in those individuals in whom the mental faculties have been developed at the expense of the physical structure.

Marked congestion may result in extravasation of blood into the follicles and stroma of the ovary, more frequently in the former. Such a hæmorrhage may lead to the follicles being distended to the size of a hen's egg or even that of an orange. This is later converted into a pigment of the consistence of honey, with a chocolate color. Such conditions have also been associated with heart disease, typhoid fever, phosphorus poisoning, and in excessive burns. Follicular apoplexy, as well as ovarian congestion, mostly occurs in the sexually immature. Such a collection may be absorbed, or the distension become so great as to

cause rupture of the ovary and a large hæmorrhage into the peritoneal cavity. Occasionally a fatal peritonitis may follow.

The tube may undergo alterations in form and situation, while the presence of abdominal tumors, especially ovarian tumors, stretch the tube out, causing it sometimes to attain two or three times its normal length. The tube may become congested from being twisted with the pedicle of a cyst. Moderate congestion results simply in the distension of the tube; more marked interference with the circulation will result in the rupture of small vessels and extravasation of blood into the tube and the surrounding parts. If still more marked, may lead to necrosis of the tube with the tumor. Congestion of the ovary and the tube is characterized by pain in the lateral region of the pelvis preceding the menstrual flow by a week or ten days. With the establishment of the flow the engorgement will be relieved, the pain ceases, and many patients experience greater comfort during the menstrual period. The flow is generally prolonged and excessive, not infrequently amounts to hæmorrhage. The patient is weak, pale, and anæmic.

**Diagnosis.**—Such a condition should be suspected as the cause of excessive and prolonged menstrual flow near puberty, when the appearance of the patient is characterized by anæmia, complains of weakness, pain, and tenderness within the pelvis, more marked upon the left side, not infrequently associated with pain in the corresponding mammary gland. Follicular apoplexy presents no distinctive symptoms, and is rarely recognized.

**Treatment.**—The subsequent progress of the patient will depend upon the hygienic management. The patient



should be taken away from school, denied the study of music and the reading of emotional literature. She should be encouraged to take out-door exercise, especially horseback- and bicycle- riding and walking. City girls should be sent to the country and sea-shore. The action of the bowels should be carefully supervised and a generous diet given, from which pastries and sweets must be largely excluded. A morning sponge-bath followed by friction with a coarse towel is advisable. During and a few days preceding the menstrual period the patient should be confined to bed. If the flow is generally excessive the period should be preceded for a few days by the administration of extract of ergot, f3ss, or ergotin, gr. ij in capsule, or a tablet triturate of hydrastinin, gr.  $\frac{1}{8}$  to  $\frac{1}{4}$  three times a day; while during the menstrual intervals potassium bromide, gr. xv, should be administered three times daily. Tonics—such as quinine, strychnine, or the bitter tinctures—are serviceable. The anæmia may tempt one to resort to the use of iron, but this remedy is better postponed until hæmorrhagic symptoms are under control.

#### Displacements of the Ovary and Tube.

Hernia through the inguinal canal is a rare condition. It is generally found upon the left side. Crural hernia is more frequent, but the ovary has also made its exit through the greater sacro-sciatic foramen and the umbilicus. Chénieux reported an ovarian cyst in the right buttock. Most probably the first surgical removal of the ovaries was performed by Potts for ovarian hernia. The hernia of the ovary is generally secondary, and results from adhesions to the omentum or the intestine. The displaced organs may readily be mistaken for glands or labial tumors. The constant presence of such a tumor; the dull,

sickening pain; extreme nausea; and great tenderness should afford a suspicion as to the diagnosis.

**Treatment.**—Taxis should be judiciously and carefully exercised. An ice- or sand- bag should be applied, and, when the reduction has been accomplished, a truss should be worn. If the hernia is irreducible, the sac should be opened and the ovary replaced or removed.

Prolapse of the ovary and tube are generally dependent upon the position of the uterus. With a retroflexed or retroverted uterus, the ovary is no longer supported upon the broad ligament, but hangs from it, and generally lies beneath the uterus in Douglas's *cul-de-sac*. The ovary may be displaced while the uterus retains its normal situation. This more frequently occurs with the left. It is characterized by tenderness, and pain during coition and defecation. Pain during the former may be so great as to preclude its performance. The condition is recognized by vaginal and rectal palpation, in which a movable mass is found which can be displaced upward or whose pedicle can be appreciated. The tumor is exceedingly sensitive, and pressure upon it causes a sickening sensation. When the condition is complicated by inflammation, the ovaries and tubes may be found fixed behind the uterus.

Treatment consists of rest, regulation of the bowels, prohibition of the marital relation, and persistent efforts on the part of the patient in the genu-pectoral position to permit the heavy organ to fall out of the pelvis. When the organ is raised up it may be maintained in place by a suitable pessary. Pessaries with heavy posterior bar are most satisfactory, as they fill up the posterior *cul-de-sac* and afford less opportunity for the downward displacement of the ovary. When

various pessaries have been unsuccessfully tried, if the patient is incapacitated for her duties, an abdominal section should be performed and ovarian fixation effected by restoration of the infundibulo-pelvic ligaments or suturing the pedicle of the ovary to the anterior parietes at a point corresponding to the exit of the round ligaments. Descent of the ovary alone does not justify extirpation.

Prolapse of the ovary and tube are very common, where these organs have become considerably enlarged; so that it is not unusual to find tubal and ovarian enlargements behind the uterus.

#### Inflammations of the Ovary.

**Oöphoritis.**—Inflammation of the ovary is known as oöphoritis and perioöphoritis. It may be either acute or chronic. We find distinctions of parenchymatous, follicular, and interstitial inflammation, but such conditions are not recognized clinically.

**Acute Oöphoritis.**—**SYMPTOMS AND ETIOLOGY.**—The patient complains of intense lancinating pain, generally in the left inguinal region, with marked tenderness, elevated temperature, rapid pulse, and frequent chills. In perioöphoritis symptoms are less marked than in mild peritonitis.

Acute inflammation is generally caused by injury, septic poisoning after parturition or abortion, gonorrhœa, arsenic or phosphorus poisoning, or the exanthemata, acute rheumatism, mumps, and long-continued endometritis. The most frequent cause is sepsis, next gonorrhœa. Sepsis is prone to result in abscess. Gonorrhœa produces perioöphoritis, with fixation of the ovary.

Acute inflammation may terminate in resolution and disappearance of abnormal symptoms, or in the development of an abscess, its rupture, the occurrence of

rapidly fatal infective peritonitis; or the disease may become chronic; most frequently is associated with disease of the tube.

**PATHOLOGY.**—In an acute inflammation of the ovary the organ is enlarged, cedematous, filled with cysts and the latter with cloudy serum resembling pus. It rapidly attains to three or four times its normal size; is filled with serous fluid, and in the more severe grades with pus; can attain the size of a man's head, but generally is not larger than a hen's egg. When inflammation results in the formation of an abscess, its watery contents can be absorbed, and leave a cheesy mass. In the milder forms resolution occurs. An acute inflammation may be followed by cirrhosis of the ovary from the retraction of the increased connective tissue. The ovary may be reduced to the size of a hazel-nut. This form of inflammation involves both ovaries, while abscess usually involves but one. In perioöphoritis the capsule of the ovary becomes thickened, and the entire organ fixed by perimetric bands of adhesion. Thickening of the capsule renders it less likely to rupture when the mature follicle and a cyst remains. A large number of such follicles form a cystic ovary. The partitions between these break down and considerable sized cysts are formed.

**TREATMENT.**—Absolute rest in bed; free purgation by salines; tincture of aconite, gtt. i-ij every hour; leeches to the perineum; an ice-bag over the seat of the pain; morphine by the rectum or hypodermically, only to control the severe pain.

**Chronic Oöphoritis.**—Chronic inflammation is much more common than the acute. It occurs during the period of sexual activity and more frequently in the married. If the ovary is large, contains a number of cysts, with increased



fibrous tissue, it is followed by an atrophy known as cirrhosis. It may be fixed in the pelvis by an extensive infiltrate, rendering it immovable, and its situation difficult to discover.

**SYMPTOMS.**—Pain, with its greatest intensity in the groin, and most frequently upon the left side. It is persistent, increased by locomotion, misstep, or jolting, and exaggerated as the menstrual period approaches. With free menstrual flow the pain is relieved or disappears. When slight, it increases. Pain extends down the thighs over the sacrum; not infrequently it is experienced in one or both mammary glands. Pain in the groin and symptoms of spinal irritation are frequently present during the menstrual periods. Pain, hysteria, and hysterо-epilepsy are associated. Sterility is a constant result. The ovaries—tender to pressure—are not much enlarged. When they are prolapsed, the symptoms are increased. Physical examination must be conducted with care. When prolapsed and fixed by inflammatory exudate, a careless observer may mistake it for retroflexion of the uterus.

Diagnosis is determined by finding large sensitive ovaries, increased distress for a week or ten days prior to menstruation, mammary pain, and painful defecation and coition. Rectal examination will be found of service.

**ETIOLOGY.**—Chronic inflammation is a sequel of the acute and due to the same causes; it is also produced by long-continued congestion from excessive sexual intercourse, masturbation, sexual excitement without gratification, suppressed menstruation, and operations upon the cervix.

**TREATMENT** consists in the removal of the source of irritation, interruption of marital relations, interdiction of vigorous exercise or long standing, rest in bed dur-

ing menstruation, extraction of blood by leeches, counter-irritation with iodine or small blisters, and the internal administration of potash salts—iodide, bromide, or chlorate alone or in combination with bitter tonics. Ichthyol is frequently of service, administered by the mouth, by suppository, or on vaginal tampons; fixation of the ovaries may be overcome by judicious pelvic massage; severe attack of pain ameliorated by tincture of pulsatilla, gtt. x, four times daily, or extract of gelsemium, gtt. v, three or four times daily. The faradic current of tension—that is, through a long, fine wire—has been found serviceable in relieving the pain.

#### **Inflammation of the Tubes.**

**Symptoms.**—Tubal disease presents no characteristic symptoms. Patients complain of pain, tenderness, and more or less induration of the pelvis as a result of the inflammation in the peritoneum. The uterus, ovaries, and tubes are fixed, not infrequently in a mass which cannot be differentiated; so that we are unable to definitely determine the position and relation of the uterus to the inflammatory collection. The progress of the inflammatory condition, the interference with the nutrition and action of the intestinal canal, and also the absorption of septic matter bring about a lowered state of vitality and a depraved state of health.

**Diagnosis.**—The history of the patient and course of the disease would indicate the existence of pelvic lesions. Bimanual examination reveals more or less fixation of the uterus, a mass situated upon one or both sides, or in Douglas's pouch, the contents of the pelvis agglutinated, with a history of pain and tenderness; a recognition of points of softening should enable us to arrive at a diagnosis of pelvic suppuration. In the

less severe inflammation, resulting in an hydrosalpinx, we will find upon one or both sides of the pelvis a retort-shaped mass, with its smallest portion directed toward the uterus and the larger extending outward into Douglas's pouch, which is movable and differs from an ovarian cyst in shape, having a retort-, or pear-, shape, rather than spherical. Fluctuation may be indistinct, according to the size of the mass.

Prolapsed intestine and varicose veins have caused difficulties in diagnosis of diseases of the Fallopian tubes. If patients are examined in the exaggerated Trendelenburg or exaggerated knee-chest position, the tumor disappears. Placing the patient in either of these positions, a little pressure will raise the intestine sufficiently far up to know that it is not a tube, or it will sometimes slip out of the pelvis of its own accord. If there are many adhesions this will not take place, but the contents of the intestine can be pressed up out of the pelvis, so that the distended canal collapses and shows that it is not a tube. Placing the patient in this knee-chest position or the exaggerated Trendelenburg position, any present disappear, and the differential diagnosis is made in that way. A. J. C. Skene (Brooklyn Med. Jour., Aug., '98).

**Etiology.**—Tubal disease is most frequently a result of infection, which may follow an abortion or labor, careless examination, or operation upon the cervix or uterine cavity. A more frequent cause is gonorrhœa, which travels through the uterus to the tubes and pelvic peritoneum. Another cause is the tubercular bacillus. This latter disease probably occurs more frequently in the tube than in any other portion of the genital structure. Less frequently it arises as a result of syphilis and actinomycosis. The most frequent cause of hæmosalpinx is ruptured ectopic gestation with retention of blood in the tube, which subsequently becomes thinned

and mixed with mucus. A collection in a tube adherent to an ovary which possibly contains a number of cysts is likely, upon increase in size of the two collections, to have the intervening wall or septum become so thinned as to break down, the two structures become one, and form a tubo-ovarian cyst or tubo-ovarian abscess according to the character of its contents. As the sac enlarges, its mucous membrane becomes smooth, and the wall gradually thinned until it forms a tumor of considerable size. The sac, as it increases in size, may drop into the pelvis, fill up Douglas's pouch, and rupture, or the escape of pus-contents, infecting this portion of the peritoneum, may produce a localized peritonitis and the formation of a large collection in the *cul-de-sac*. Occasionally two infected tubes may drop down into Douglas's cavity, their ends become united, and a large double pyosalpinx form, the sac consisting of the two dilated tubes.

**Pathology.**—Inflammation of the tubes occurs in the form of acute and chronic inflammation. Chronic inflammation results in salpingitis, perisalpingitis, accumulation of fluid in the tube forming an hydrosalpinx, pyosalpinx, or hæmosalpinx, according to the activity of the inflammation and infectious character of the germs. Inflammation consists in, first, thickening of the mucous membrane, frequently desquamation of its epithelium, and enlargement of the tube. The longitudinal folds of mucous membrane, becoming abraded and lying in apposition, infrequently become adherent, forming what appear to be cysts. At other points, particularly in the isthmus of the tube, thickening of the membrane occurs, forming pea- to bean- sized nodules, which are spherical in form, with sharp margins, and give the impression of tumor-formations. They are firm in



consistence, thick, vascular structures, sometimes also double sided, and symmetrical. This inflammation has been denominated the salpingitis nodosa isthmica. With the extension of the inflammation to the mucous membrane, increased secretion follows, portions of which are discharged into the peritoneal cavity, and cause an inflammatory condition, which causes the plastic material to be thrown out, and close up the end of the tube. With inflammation and thickening of the mucous membrane, it becomes contracted and leads to retraction of the fimbriæ, or by the contraction of the muscular layer it pushes the peritoneum over the abdominal orifice, which becomes agglutinated and closes the opening. Occasionally one or more fimbriæ may protrude, thus leaving a track by which fluid subsequently may escape into the peritoneal cavity. With the closure of the tube the increase of contents causes an obtuse-ended tumor, which gradually fills with fluid, forming occasionally a pear-shaped mass, or, where its walls are in places constricted by an increased amount of fibrous tissue, a sausage-shaped tumor is formed. This sac, when its contents are serous, is an hydrosalpinx, and occasionally becomes greatly distended, forming a sac as large as a child's head, which increases in size toward the abdominal end, and presents a thin-walled tumor which is more or less free, and about which adhesions may be entirely absent. In a more acute infection the contents become purulent, and with pus-contents we have an inflammation extending through the wall of the tumor, involving its peritoneal surface, and not infrequently causing extensive peritoneal inflammation by which everything in the pelvis is matted together. Such a sac may subsequently rupture, spread out the broad ligament, and form

a pelvic abscess of considerable dimensions. If the adhesions are firm between the intestine or bladder and sac, rupture may occur either in the intestine or bladder and decrease the tumor from the discharge of pus; or the wall may become so thinned as to permit its discharge through the abdominal walls, into the vagina, or more seriously into the peritoneal cavity, when it is followed by rapidly fatal septic peritonitis. When the sac empties into the bladder or intestine, it does so at a level which does not permit the entire sac to be drained, and consequently it is only the overflow that escapes. The patient is subjected to a long-continued drain, which results in increased anæmia and debility.

**Treatment.** — Palliative treatment in these conditions is of no avail. If the patient is in an acute attack one may prefer to bring about a subsidence from the acute symptoms. Place the patient in bed, administer purgatives, and apply an ice-bag. No hope for permanent relief can be asserted until the sac is evacuated or removed. The method of treatment, however, will depend somewhat upon its situation and size. A large collection filling up Douglas's pouch, or distinctly recognized through the vagina, is preferably attacked by vaginal incision, in order to remove the large quantity of infectious material without bringing it in contact with the peritoneal cavity. Collections of pus may be evacuated by free vaginal incision, through the posterior vaginal fornix; expose the sac and make an incision into it through which its contents are evacuated. The sac is thoroughly irrigated, and an examination made as to the existence of further collections. If any exist, they are broken open and evacuated. Where the sac is readily separable it may be gradually drawn down and removed through the

vagina. If, however, there is more or less fixation of the thoroughly opened and irrigated sac, it is packed with iodoform gauze, which is permitted to remain the greater part of the week, the cavity being irrigated, after its removal, with formalin solution (1 to 2000) and re-packed. The procedure should be continued every few days until the sac has contracted, when it may be omitted. Occasionally this operation will result in obliteration of the sac and cure of the patient. It should always precede an abdominal section whenever there is a large collection of pus that can be reached *per vaginam*. The only objection to the plan of treatment is that it is not always curative; the secreting surface remains and the sac may again close and refill. The effective operation is to open the abdomen, break up the adhesions, and remove the infected tube and ovary. This operation is greatly enhanced by placing the patient in the Trendelenburg posture, by which the sight as well as touch may be exercised in the enucleation and removal of the mass.

While extirpation of a tubal sac is the proper treatment in large collections, whether of blood, pus, or serum, abdominal section should not be considered as required in every case of tubal inflammation. In the slighter forms of disease, and in the early stages, the hygienic measures already indicated, supplemented by palliative curettement and the drainage of the uterus, will often be sufficient to establish a resolution of the slighter forms. The maintenance of uterine drainage will often be sufficient to establish a cure, both clinically and functionally. In other words, patients who have had extensive tubal inflammation of gonorrhœal origin have recovered and subsequently given birth to children. I have observed this sufficiently frequently in

my own practice to make this assertion without question. Occasionally the uterine end of the tube remains patulous, permitting, in certain positions of the body or in overaccumulation, the evacuation of the sac through the uterus and its disappearance until it again refills. This condition is known as hydrops tubæ profluens.

The extension of inflammation from the uterus to the tubes and the existence of inflammatory products in that organ after the removal of the tubes, which not infrequently causes nervous and other manifestations, led Péan and his followers to advocate the removal of the uterus *per vaginam* whenever the condition was such as to require the removal of both ovaries. This operation may be done either by clamp or ligature. The clamp operation is the more expeditious. The ligature, while longer, is safer.

The operative procedure consists, first, in thorough cleansing and disinfection of the vagina. The cervix is seized with a double tenaculum, and the vagina incised with scissors, knife, or—preferably—with a thermocautery-knife. Incision with the latter prevents hæmorrhage from the vaginal wall and promotes drainage through the longer duration required in the union of the vaginal wound. The incision completely encircles the neck of the uterus and may extend one-half to three-fourths of an inch on a line posteriorly to the broad ligament. Pus-collections in either the tube or Douglas's pouch should now be opened and thoroughly evacuated, and the cavity irrigated before the adhesions are broken up, which removes an extensive source of infection.

The separation of the bladder from the uterus is accomplished by blunt dissection and the tissues are pushed off posteriorly in the same manner until the



peritoneum is reached. By the dissection, we may frequently strip out a good portion of the cervix without the necessity for ligating vessels. Having reached the peritoneum in front and behind, a fold of the broad ligament is then secured on either side by ligature or a clamp, and incised, which sets free the cervix. We may now proceed to drag down the cervix, ligate and cut the remaining portions of the broad ligaments on each side in a similar manner, or the cervix may be amputated and the fundus of the uterus rotated downward through the anterior incision. This procedure permits the passage of the finger over the fundus, to follow up the broad ligaments, and accomplish the enucleation of the ovary and tube. The ovary and tube are usually prolapsed backward from their weight, and this manœuvre renders them tense and enables the operator with the finger to follow more readily the line of cleavage between the tube and ovary and the other tissues.

After the sac is separated and enucleated, the remaining portion of the ligament is ligated and cut. This is usually first done upon the left side, which gives us more room to follow the same procedure upon the right. If ligatures are used they should be firmly tied, and the ends cut to prevent traction, which may pull them from the stump. A retracted stump is quite difficult to reach, and in dragging it down the ovarian artery may slip back and bleed. The stumps are temporarily held with clamps, so that they may not be retracted beyond our reach when we choose to close the vaginal wound.

With the completion of the operation the surfaces are carefully inspected for bleeding-points, the vagina and the pelvis irrigated with a normal salt solution, by which the blood and discharge are

completely removed. In the majority of these cases extensive tearing and denudation has been necessary, which will result in the escape of the serous effusion or even blood; it is preferable not to close the vaginal wound, but pack the cavity with iodoform gauze. This gauze packing is permitted to remain from six to eight days. When removed, plastic exudation, which has been thrown out around it, will hold up the intestines and prevent their prolapsus. The tampon, however, should be replaced by a smaller one, which is permitted to remain for a few days. The sutures may be silk or catgut, preferably the latter, as the silk is almost certain to become infected, and will prove a source of irritation until they are finally thrown off or disintegrate. The catgut is of much shorter duration and much less likely to cause trouble.

The vaginal operation is not applicable to all cases. It should not be preferred when there is any hope of saving the uterus and the appendages of one side. It is only in those cases in which the examination has demonstrated the necessity for the sacrifice of both ovaries and tubes, that the extirpation of the uterus should be considered. Where a partial operation is done, the preferable route will be by the abdomen, as it permits us the better to inspect the condition of the peritoneal cavity, to break up adhesions, and suitably treat the partially diseased organ, which may remain.

The consensus of opinion from the indications given by the operators of the widest experience is that conservative operations on the tube and ovaries may be practiced: 1. For new growths of benign character, for myoma and fibroma of the tube, simple cysts, dermoids and fibroids of the ovary, and parovarian cysts. 2. The tube and ovary ought not to be sacrificed as a matter of convenience to the operator. It is contra-indicated in malignant or in papillary dis-

ease. 3. For chronic oöphoritis and cystic degeneration. 4. For hæmatoma of the ovary and tube (perhaps hardly a consensus of opinion here). 5. For inflammatory diseases of the appendages, where the acute stage has subsided, provided that there is no suppuration in the pelvis or in the ovary, that the contents of the tube are serous or hæmorrhagic, and prove sterile on immediate cover-slip bacteriological examination (Schauta, Wertheim), and that the inner end of the tube is patent. For conservation to be rational it is essential that part of the ovary should be capable of function; if both ovaries have to be entirely removed, there is no reason for retaining the tube; the state of the ovaries must govern the method of procedure. 6. Conservative operations on the tubes should be limited to the child-bearing period. Up to the present it is uncertain whether an ovary, the seat of a small cystoma, may be safely resected or whether a tube, dilated by old sterile pus can be safely opened up. Some of the American surgeons show special boldness in the presence of pus. With regard to the tubes, the majority of conservative operations are undertaken when the abdomen has been opened for gross disease of the appendages upon one side, and less advanced tubal disease has been revealed. In considering the method to be adopted in dealing with the tubes, certain points stand out: the artificial ostium should be wide enough to allow of later contraction, if necessary, by slitting the tube longitudinally. Provision should be made for eversion of the mucosa in order to obtain, as far as possible, the conditions present in the normal ostium abdominale. Care should be taken, by suture or otherwise, to leave the new opening in the tube in juxtaposition with the ovary. The energetic disinfection of the tubes by antiseptics practiced earlier, is unnecessary if the cases are suitably chosen, and all measures likely to irritate the peritoneum are to be avoided. It is still undecided whether resection or ignipuncture of the ovary is the best operation for chronic oöphoritis and cystic disease. That resection may be followed by ad-

hesion in some cases has been proven by observation. We are not yet in a position to determine how far the technique adopted (*i.e.*, the kind of suture used and the method of suture) is responsible for such adhesions. Florence N. Boyd (Brit. Jour. of Obstet., March, 1903).

### Tumors of the Fallopian Tubes.

**Benign Growths.**—Tumors of the tubes and ovaries may be benign or malignant. The benign tumors of the Fallopian tubes are exceedingly rare, excepting those which are the products of inflammatory changes, and have already been given.

**Fibroma, or myoma,** of the tube is an infrequent growth, and attains to small size. It arises from the muscular tissue of the tube, and may grow inward or become subperitoneal; it rarely obstructs the calibre of the tube. Inflammatory and tuberculous changes have sometimes been mistaken for this growth, particularly the condition known as salpingitis nodosa.

Recklinghausen has described a form of fibroma characterized by fibroid constituents and including glandular structure. This growth is attributed to some remains of the primordial structure. The *fibrocyst* of the tube is so rare that but a single case has been described, that of Sängner-Barth, which consists of three tumors, the conglomeration of various large cysts, firm tumors that were in part pedunculated from the fimbriæ of an otherwise healthy tube. Under examination the products greatly resemble a teratoma. *Enchondromata* are small cartilaginous masses found in the ends of the fimbria.

**Dermoid cyst** of the tube is exceedingly rare. Ritchie described one which contained a plum-sized bone. Pozzi has also described a dermoid cyst removed from the tubal wall. Cysts of small size



are frequent. The large irregular bullæ so common in association with fibroid growths are said to be dilated lymph-spaces. Cysts which vary in size from a pea to a walnut are found in the walls of the tube, but most frequently beneath the peritoneum. Cysts within the tube are generally the result of adhesions of adjoining folds of the mucous membrane. *Polypus* is a rarely recognized growth. Lewers reports a case in which the inner surface of the tube was studded with such growths varying in size from a pin's head to a pea. *Papillomata* of the tube, considered as adenoma by Sutton, are allied to the condylomata, or warts, of the vulva; they consist mainly of epithelium. These growths are difficult to differentiate from sarcoma and cancer, but are evidently benign.

**Malignant Growths.**—*Carcinoma* of the tube may be either primary or secondary, though the latter is much the more frequent. The secondary involvement may take place from either the ovaries or the uterus. Doran divides primary cancer of the tube into two forms: where the cancer first develops in mucous membrane of a normally-formed tube; second, where it forms in a malformed tube, bearing a cyst whose wall becomes infected.

Case of primary carcinoma of the Fallopian tube. Thirty-one have already been recorded. The ages of the patients varied from forty to sixty years. The menopause does not seem to be an important factor in the development of the disease. Salpingitis has a direct bearing upon it. Boursier and Venot (*Revue de Gynéc. et de Chir. Abdom.*, No. 2, 1901).

Sarcoma of the ovary is frequent; of the tube very rare. Sarcomatous nodules are sometimes found scattered over the peritoneal surface of the tube, but it more frequently passes from the ovary to the omentum. Deciduoma malignum

can occur in a portion of the placenta or chorion of the tube. It forms in the tubal sac as readily as it would in the placenta or chorion of the uterus. The possibility of such an occurrence is urged by Säger as an additional argument for active interference for the extirpation of tubal moles and the appendages after tubal abortion.

### Tumors of the Ovaries.

These tumors differ from the other neoplasms in their greater propensity to malignant degeneration, often rendering it difficult to determine whether the individual growth is malignant or benign; consequently we will discuss the two classes of tumors together.

**Classification.**—Tumors of the ovary are divided clinically into *cystic* and *solid*; pathologically into *simple*, *proliferating*, *dermoid*, and *parovarian*. By size, into small and large. The cystic comprise the simple, proliferating, and the dermoid. Solid tumors, less frequent, are the fibromata, sarcomata, and carcinomata. Cysts may originate in any part of the tubo-ovarian structure, as the cortical, medullary, and parenchymatous portions of the ovary, and in the structure between the tube and ovary known as the Rosenmüller organ, or parovarian structure, of which the hydatid of Morgagni, the extremity of the canal of Müller, is an example. Cysts which develop in the folds of the broad ligament are known as broad-ligament cysts.

**Cysts.**—Cystic growths attain almost unlimited size, larger than any other growth, and occasionally the body seems but an appendage to the tumor. They rapidly reach the weight of one hundred pounds. Maritan recently reported an ovarian cyst weighing two hundred pounds, removed from a woman who had previously weighed two hundred and ninety pounds. Her girth measure was

ninety inches. Solid tumors closely retain the shape of the ovary; cystic are irregularly spherical,—the larger they become, the more spherical. The surface of the cyst is a bluish white, greenish, brownish, yellow, or a glistening white. Secondary developments in the cyst-wall may give it an irregular shape. Cysts are still further divided into unilocular, or single cysts, and multilocular, where the cysts are divided into a number of cavities or smaller cysts within its walls.

The contents of the various tumors greatly differ. Indeed, the different cysts in the same tumors show radically different contents. In the unilocular tumors the contents are usually clear and limpid; in the multilocular, thick, viscid, and glue-like. In some chambers it may be clear and limpid, in others thick and viscid, or, again, mixed with pus, blood, or fat. Cysts of the broad ligament are generally unilocular and contain clear fluid. Those which originate in the hilum are papillary, and those from the parenchymatous structure of the ovary glandular. The small cysts are described as: first, small residual cysts which develop from the horizontal canals of the parovarium, with which may be included the hydatid of Morgagni; second, follicular cysts; third, cysts of the corpus luteum; fourth, tubo-ovarian cysts.

The large cysts are: first, the glandular proliferous; second, the papillary proliferous; third, the dermoid, simple and mixed; fourth, parovarian, including several varieties, as hyaline, papillary, and dermoid.

Cases of cystic degeneration of the ovary are divisible into three groups, viz.: 1. Those in which the ovary is filled with small cysts, showing various stages of degeneration, where it is difficult to decide macroscopically whether the condition is normal or pathological.

It seems to represent essentially an increase in physiological processes. 2. In this group the changes are more evident, as some of the dropsical follicles attain a considerable size and others atrophy. Hyperæmia is more marked, with resulting hæmorrhages; so that some follicles lose their lining epithelium and are filled with coagula. 3. In the third group the cystic formation is general, though ova can still be found in some of the follicles, even when they are denuded of epithelium. Degeneration of the ovum is often preceded by changes in the membrana granulosa.

Microscopically, in the majority of the cases, so-called *hydrops folliculi* are due to glandular formations following ingrowth of the germinal epithelium, and not to simple dilatation of a pre-existing follicle. Moreover, this mode of origin can be inferred in some cases of ordinary cystic degeneration. Kahlden (*Beiträge zur path. Anat. u. zur Allgem. Path.*, Bd. xxxi, 1902).

Small residual cysts develop in the structure between the tube and ovary, known as the parovarian structure, or organ of Rosenmüller. Those originating in the vertical tubes have ciliated epithelium, and may subsequently develop into papillary growths. They are detached from the ligament and hang from the peritoneal surface by a slender pedicle. Attached to the fimbriated end of the tube is generally found a small cyst varying in size from a pea to a cherry, known as the hydatid of Morgagni, which from its almost constant presence is regarded as a physiological cyst.

Follicular cysts, or *hydrops folliculorum*, are small cysts which are unilocular, dilated follicles, generally multiple and small. In an ovary which has not attained twice its size, fifteen or twenty of these cysts are often found. They were long considered as the sole source of large ovarian cysts, but it is in rare instances only when they attain the size



of a fist, occasionally that of a man's head. The contents of the cyst are generally clear, may be blood-stained, and have a specific gravity of 1005 to 1020. The cyst-wall is a transparent, thin membrane of light-gray color, covered with columnar epithelium. The ovarian stroma may be excessive or the reverse. In the latter condition the ovary is frequently converted into a mass of delicate cysts. The disease is generally bilateral. These cysts are unruptured and dilated Graafian follicles. In the smaller ones ovuli may be detected. Failure to rupture and increase of fluid contents increase the atrophy of the follicle. Rupture may be prevented by undue thickness, or toughness, of the ovarian wall, which results from inflammation, or deposits of exudation upon the surface of the ovary. It also is caused by a deep situation of the developing follicle, or a very slight congestion, insufficient to furnish proper secretion to produce rupture. These cysts have been found in an ovary prior to menstruation; indeed, in the foetal ovary. They rarely give rise to symptoms.

Cysts of the corpus luteum are unilocular cysts the size of a pigeon's egg, occasionally that of an apple. They were described by Rokitansky, and it was supposed they could only occur in the corpus luteum of pregnancy, but they have been found in the nullipara.

**Tubo-ovarian cysts** arise from contact with the distended tube adherent to a cyst of the ovary. The increasing pressure of the accumulating fluid gradually absorbs the thin septum, and the two sacs form one cavity, the smaller portion of which is usually formed by the tube. The uterine end of the tube can remain permeable and, as the fluid increases, permit the overflow to drain through the uterus. Such a condition is known as a

profluent tubo-ovarian hydrops, which resembles ovarian hydrops tubæ profluens. The open tube acts as a safety-valve and prevents increase from distension of the cyst.

**Large Cysts.**—Proliferating cysts comprise the great majority of ovarian tumors and vary in size from an egg to that of a tumor weighing over one hundred pounds, which fills up the abdomen and encroaches upon the thoracic viscera. The surface of the cyst presents a pearly-white, glistening appearance, the thinner portions of which are purple, green, or black, according to the color of their individual contents. The external surface may be smooth or covered with papillary growths or mucous vegetations. The glandular proliferous are highly organized and richly supplied with blood-vessels. The glandular proliferous have the faculty of budding or generating new cysts from within the original growth. They may be spherical in shape and regular in outline, simulating a single cyst, or be irregular from numerous nodules, which indicate a multilocular tumor. These growths generally have a distinct pedicle, which is the attachment of the tumor. The pedicle may be long or short, thin and band-like or broad and thick. Occasionally the tumor is sessile. The latter are frequently intraligamentary. The pedicle is developed by the traction of the tumor and the resulting hyperplasia of the ovarian ligament and stretching of the meso-ovarium. The tube generally remains separated by its mesosalpinx from the tumor, while the ampulla is often fastened to or approaches the sac. The tube is usually elongated. In ovariectomy the tube is generally removed with the pedicle. The pedicle varies in length from four to twenty centimetres; in breadth, from two to twelve centimetres, and may be

entirely absent. The tendency to absence of the pedicle depends somewhat upon the variety of the cyst. In glandular, the tendency is to a long pedicle; in papillary, to short or absent pedicle; and in dermoid, it is short and strong.

Summary of 23 ovarian tumors weighing over 100 pounds collected from literature, and history of a personal case in which the weight of the tumor, sac, and contents was 245 pounds: 43 pounds more than any cyst yet recorded. In 24 cases, 15 recoveries followed operation. The average weight of the tumors was 129 pounds, while in 6 cases followed by death the average weight was 181 pounds. The fatality from operation in such cases thus appears to be directly proportional to the size of the tumor. Extensive adhesions also militate against successful operation. Primary aspiration is apparently no safer than immediate operation. Marsupialization is contra-indicated. Successful tapings are sometimes tolerated, but usually lead to exhaustion and death in a few hours. Death is apt to occur within a few hours as the result of shock, but, if this danger is passed, the fatal issue is likely to be the result of intestinal obstruction following adhesions. Bullitt (*Annals of Surg.*, Jan., 1900).

**STRUCTURE.** — The internal structure of glandular cysts justifies their division into the areolar, unilocular, and multilocular. The glandular cysts, Virchow says, originate in the invagination or proliferation of the epithelium in the stroma. Continuation of these processes causes the formation of a many-chambered, glandular, or adenomatous cyst. An areolar cyst is a conglomeration of small cysts, with thick, well-developed and vascular stroma. A number of cysts may have ruptured to form a considerable-sized one or the entire tumor may be made up of a large number of small masses, none of which will exceed the size of a plum. Unilocular cysts often attain an enormous size, but examination

will disclose evidence of a previous division into numerous smaller cysts; so it may be asserted that all unilocular cysts originate from multilocular ones. A careful investigation will usually disclose small cysts in the wall, not infrequently the remains of septa in its cavity. Multilocular cysts contain a number of cysts of varying size, so arranged as to present the appearance of a single tumor. By the increase of the individual sacs, their intervening walls gradually become thinned until one after another they rupture, and the sacs coalesce to form larger single chambers. These remains of septa become still more stretched as the tumor increases in size, until they present only a cord-like surface on the inner margin of the tumor. Occasionally the vascular structure alone remains to indicate the former septum. In sudden rupture vessels of the septa are torn and extensive hæmorrhage may follow, changing the character of the sac-contents. Upon examination of a large cyst we usually find a wall with three layers, the outside consisting of pure connective tissue like the albuginea of the ovary, the middle of loose connective tissue with numerous large vessels, while the inner is rich with cells and contains numerous small vessels. The external surface of the cyst is covered with columnar epithelium, and it is lined with one layer of cylinder epithelium, which presents different forms in different tumors, and by its structure governs the character of the secretion in the various sacs. In the larger cyst the epithelium undergoes degenerative changes, through thinning of the septal wall. Fatty or albuminous changes cause the epithelium to disappear entirely from the wall of one or more of the larger cysts. Pfannenstiel has directed attention to the possibility of the formation of papillary growths in



the glandular cysts. These growths may be sparsely distributed from the inner surface of a large cyst; in others they appear as circumscribed tufts in one side of the cyst, while the remaining portion is smooth, or, again, the entire cavity may be filled with strong, branching growths, while the quantity of fluid is very scant. The larger the cyst, the greater the probability that a large portion of the wall is smooth. Cyst-contents often present a very great contrast in color and consistence, as almost colorless, a straw color, green, purple or black, thin or thick, viscid or gelatinous. The contents of the various cysts in the small tumor differ in color and consistence, in some the fluid will be thin and in others so viscid that it will not flow. The contents of smaller cysts are more consistent, and become thinner as the cysts increase in size. The specific gravity of the fluid varies from 1002 to 1020, with an average of 1012. The fluid, however viscid it is, is absolutely structureless. It contains blood-corpuscles, epithelial cells, and crystals of cholesterin, while its reaction is neutral or alkaline. Upon analysis, various forms of albumin, metalbumin, paralbumin, and albumin peptone are found.

Contrary to the opinion now almost universally accepted, that in simple ovarian cysts, especially in cases of hydrops folliculi, we have to do with retention cysts of Graefe's follicles, the writer, on the basis of careful investigations (always of both ovaries) in a series of cases points out that it is rather an adenomatous new growth developing from a sinking in of germinal epithelium. The observation is one of great importance in regard to the histogenesis of papillary and glandular cystoma. The question whether the complex formation of papillary cystoma may be developed from insinkings of ciliated epithelium the author does not consider ripe for discussion. The ova found in such cysts

by earlier authors, which were the essential basis of the views hitherto prevailing, are also, according to the writer's investigations, partly the products of degeneration of epithelial cells, partly egg-like forms due to transformatory or new-growth processes in the epithelia of the cyst. V. Kahlden (Brit. Gynæc. Jour., from Ziegler's Beitr. z. Path. Anat., B. 27, H. 1, 1900).

Papillary proliferous cysts present marked proliferation of the connective tissue, which forms tufts upon the inner surface of the tumor. These branching projections may distend the sac to bursting, the tuft project upon the outside, and lead to rapid infection of the general peritoneum. Vegetations spring up luxuriously over the surface of the ovary, and are carried to every part of the peritoneal cavity, and not infrequently by aspiration are made to penetrate the diaphragm into the thorax. The contact of the peritoneum with the infection produces extensive ascites. Similar vegetations may arise spontaneously upon the surface of the ovary, and are then known as superficial papillary. These are cases in which a small cyst is opened and infects the external surfaces. Papillary tumors rarely attain a large size, but are generally bilateral. The dendritic growths project in every direction. The projections are reddish or pearly white and glistening, often three or four inches long, and have the appearance of stems of coral. Masses occasionally undergo partial calcification; so they break easily and without bleeding.

Migrated ovarian and parovarian tumors: *i.e.*, growths that have by torsion and tension of the pedicle become entirely detached from their former connection with the broad ligament, and either lie free in the abdominal cavity or have formed new attachments to other organs or tissues. Four cases reported. Recovery followed operation in all these cases. Forty-three cases found in litera-

ture. The migrating organs consisted of free ovaries, 3; parovarian cysts, 3; ovarian cysts, 21; ovarian dermoids, 15; cystosarcoma of the ovary, 1. G. M. Edebohls (Med. Record, Aug. 18, 1900).

**Dermoid Cysts.**—These are growths in which are found skin and mucous membrane, with all the structures generally associated with such tissues. The tissues most frequently found are teeth, hair, nails, and sebaceous and sweat-glands. Other structures occasionally seen are mammæ, horn, bone, unstripped muscular fibre, and very rarely tissue resembling brain. Fat or sebaceous material at the temperature of the body is generally in the liquid state. Occasionally they are found in solid balls. Sutton reports finding three hundred of these in one sac. Hair is frequently present in great abundance, and varies in color, length, and quantity. It may be blond, brown, or black, but bears no relation to the color of the individual. Teeth are found in about one-half the cases, and may be loose, fixed, or buried in the wall. All varieties of teeth are found. Schnabel describes a case which had three pieces of bone and one hundred teeth. Plouquet found three hundred teeth. Various bones have been described, as the jaw, petrous portion of the temple, ribs, and pelvic bones, a finger with articulated phalanges, nail and nail-fold, or entire skeleton has been recognized. Dermoids do not always occur alone, but in conjunction with large glandular cysts, the dermoid forming a small part of the mass.

Ovarian dermoids believed to be due to simultaneous irritation of histologically different portions of the parenchyma, each portion responding to this irritation in its peculiar way. Dermoids are usually found in combination with pseudomucin cysts, which, in all probability develop from the follicular epithelium, the combination with cysts lined with ciliated epithelium. Pfan-

nenstiel (Amer. Jour. Med. Sci., Oct., '97).

Dermoid and teratoid tumors of the ovary are ovulogenous, since they always present evidences of the three embryonic layers. It may be assured that their manner of development is not one of pathogenesis, since the latter is a physiological process. The cleavage of the ovum from which a dermoid develops is pathological. Only the earliest portions of the embryo develop, hence the prominence of the ectoderm and cephalic end, while the remaining portions either do not develop at all or are deformed. The differentiation is one-sided, and is sometimes confined to a single organ, such as a breast. In connection with this subject the question of the differentiation of sex in the ovum presents a suggestive field for future study, though the expectation of affecting this result, as claimed by Schenck, may be dismissed as vain. Kroemer (Archiv f. Gynäk., B. 57, H. 2, '99).

**Teratoma** is a more complete form of growth of tumor which is usually classed with the dermoid. It often attains to an enormous size, contains the various structures of the dermoids, cartilage, and a large amount of connective tissue. Dermoid growths can appear at any age, have been found in children at birth, and in women of ninety years. The contents of the dermoid sac are exceedingly irritating, and every precaution should be practiced to prevent their escape into the peritoneal cavity.

**Parovarian Cysts.**—The parovarium, or epoöphoron, is situated in the lateral part of the mesosalpinx and is a remnant of the Wolffian body. Parovarian tumors are almost always cystic and subserous, and consequently have a double wall. The external peritoneal is easily separable. The pedicle consists of the tube, median ovarian ligament, and the suspensory ligament. Paroöphoron and broad-ligament cysts form about 11 per cent. of abdominal tumors of pelvic



origin, and both proliferating and dermoid growths have been found in this situation. They are distinguished from ovarian, first, by the ease with which the peritoneum can be stripped off; second, by the ovary being generally found attached to the side of the cyst; third, by the cyst being unilocular; fourth, by the Fallopian tube stretching over the cyst, never communicating with it; lastly, the gradual thickening of the mesosalpinx.

Solid growths of the ovary comprise 5 per cent. of the cases presenting themselves for operation. These tumors are innocent or malignant, and may become cystic.

**Fibromyoma** is a benign form of rare tumor, but the most common species of solid ovarian tumor. The growth is slow and maintains the normal shape of the ovary. Adhesions are rare. Williams described one which weighed seven pounds seven ounces; Doran, one of seventeen pounds.

**Sarcoma of the ovary** resembles in form, size, and color a fibroid, excepting that its surface is smoother; its consistence is softer than a fibroid, though it contains much fibrous tissue, making the diagnosis at times difficult to determine. It occurs in the round and spindle-cell growths. The latter predominating, the tumor is more solid and more strongly resembles the fibroid. Spindle and round cells are frequently combined, while myxomatous transformation exists in both kinds, but cartilage- and bone-formation rarely occurs. Sarcoma combined with carcinoma has been observed in the walls of larger cysts.

Fibrosarcomata of the ovary are always bilateral, occur in young as well as in old subjects, and grow slowly, ascites being usually present. The entire ovary is affected, but maintains its usual form even when much enlarged, although the

surface becomes more or less nodular. On section they show a firm, homogeneous structure with myxomatous softening in the interior; cysts may result either from the latter cause or from the dilatation of follicles. Histologically they present more or less marked hyperplasia of the ovarian connective tissue, and may be characterized as fibrosarcomata, rich in cell-elements, and with a tendency to mucoid degeneration.

Although these growths may remain stationary for a long period, they have a marked tendency to become disseminated through the lymphatics, first within those of the ovary itself, then in the vessels of the tube and corresponding broad ligament, and often in distant parts of the body. Krukenberg (*Archiv f. Gynäk.*, B. 1, H. 2, '96).

**Carcinoma of the ovary** is much more rare than sarcoma. The medullary formation is the most common, and may form a tumor quite as large as a man's head.

**Symptoms of Ovarian Tumors.**—Early stages of ovarian tumors produce no symptoms. Occasionally an apple-sized tumor, though movable, may cause unpleasant symptoms, as pain in the sacrum, which extends down the leg. Intraligamentary tumors or those prevented by adhesions from rising out of the pelvis produce severe symptoms as soon as they fill the space, especially by obstruction to stool and micturition. In large tumors distress arises from pressure, and interference with the circulation and respiration. The skin becomes stretched and forms striæ, swelling of the navel, hernia, occasionally from pressure upon the great vessels, œdema, varicosities in the legs, in the sexual apparatus, and in the skin of the abdomen. Albuminuria, diminution of urine, and compression of the renal veins are observed. Severe compression symptoms are now rarely seen from large tumors, as they are not permitted to attain large size. Menstrua-

tion is usually unaffected. It disappears comparatively early in those cases in which the follicles perish from the development of sarcoma, carcinoma, and the papillary cystadenoma when bilateral. Menstruation decreases, and the disposition to menopause is betrayed, not from absent ovulation, but as a result of constitutional conditions. Amenorrhœa may exist for several years and menstruation return after the removal of an ovarian cyst.

The disappearance of an abdominal cyst following the passage of large quantities of urine, usually regarded as pathognomonic of intermittent hydronephrosis, may also occur in connection with ovarian cysts.

The difficulty of distinguishing between such cysts and hydronephrosis is greatest when the tumor fills the abdominal cavity. The relation of the large intestine to the cyst is most important, since it is only exceptionally that it lies in front of one of ovarian origin. If the gut is collapsed it may be distended by injections of effervescent salts. Vaginal examination will often throw light on the diagnosis; also catheterization of the ureter. Wilson (*Birmingham Med. Rev.*, Aug., '97).

Pleuritic effusions frequently occur in cases of ovarian tumor as a consequence of the condition. Effusion develops insidiously without pain or temperature, is most frequently bilateral, and, if unilateral, the right side is more commonly affected. It is not due to circulatory disturbance, nor to any alteration in the character of the blood, but to a propagation of the disease to the pleura, or more frequently to pleuritic reaction from irritation transmitted through the diaphragm. Sometimes it is due to an abnormal peritoneal irritation, especially in cases where ascites is present. When a pleuritic effusion not due to acute pleurisy appears in cases of ovarian tumor, it is a sign of the malignancy of the case, especially if we can exclude torsion of the pedicle, suppuration, and rupture of cysts. When the effusion is not due to extension of the disease to

the pleura or lungs, operative interference is indicated, but operative interference must be determined by the situation and extension of possible peritoneal foci, as it is in these cases that pleuritic effusion most commonly occurs. Paracentesis thoracis may, in rare cases, be preparatory to laparotomy, but complete removal of the tumor is the surest way of removing the effusion. G. Resinelli (*Med. News*, Jan. 29, '98).

In ovarian cysts extensive adhesions may develop during pregnancy as well as after delivery. Torsion of the pedicle may follow the emptying of the gravid uterus in consequence of the sudden change in the intra-abdominal pressure. Infection of the cyst during the puerperium is well known, Zetter having reported twenty-one cases. Gottschalk (*Frauenarzt.*, Nov., '98).

The Fallopian tubes are generally lengthened by the growth of ovarian and parovarian cysts. The tubes rarely become thinner, generally growing thicker, broader, and longer. Table of fourteen cases in which measurements were made post-mortem. These show that the Fallopian tubes in women, except during the pregnancy or the puerperium, measure from 9 to 9½ centimetres in length, not including the uterine part of the tube, which is from 0.7 to 1 centimetre long. The isthmian end has a diameter of from 2¼ to 4½ millimetres; the ampulla, from 3¾ to 5½ millimetres. The lumen increases proportionately with the distance from the uterus. Harry Lepman (*Zeits. f. Heilk.*, vol. iv, No. 2, 1901).

**Diagnosis of Ovarian Tumors.**—Diagnosis of ovarian tumors is mainly secured by physical signs. The questions to be considered are: first, have we a tumor under consideration; second, the existence of a tumor recognized, is it an ovarian growth; third, an ovarian tumor admitted, we ascertain its relations to the surrounding parts, the existence or absence of a pedicle or adhesions; fourth, the variety of ovarian tumor. For purposes of convenience of diagnosis ovarian growths are divided into two classes:



those small, and situated within the pelvis, and the large, where they rest upon its brim. The abdominal enlargements other than tumors with which the ovarian growth may be confused are obesity, dermoid tumor of the abdominal walls, ventral hernia, tympanites, fæcal accumulation, distended bladder, and ascites.

In obesity the history of development, the general distribution of adipose, and the thickness of fat-accumulation in the abdominal wall should be contrasted with the general emaciation which characterizes a large ovarian cyst.

DERMOID tumor of the abdominal wall occurs in the muscle-wall, taking the nature of a fibroid. From its weight, it becomes very dependent; sometimes extends to the knees; is quite movable, very superficial, and hard. Its situation in the wall, its density, and failure to recognize by vaginal or rectal examination any connection with the pelvic viscera should determine its character.

VENTRAL HERNIA.—The recognition of the coils of intestine, and peristaltic action, through the thin wall, is sufficient. Tympanites or phantom tumors, a condition similar to pseudocyst, is sometimes mistaken for ovarian cyst. A loud volume of resonance is easily recognized, and differentiates it from a cyst. It is true that occasionally a cyst may have a communication with the intestine, which will permit gas to enter it and thus afford resonance. Even in these cases a sensation of fluctuation is secured which is absent in the phantom tumor. The latter tumor entirely disappears when the patient is placed under an anæsthetic.

FÆCAL ACCUMULATION occurs in the colon or transverse portion of the gut, which may descend and lie directly over the pelvis. The accumulations are occasionally quite extensive, but are recog-

nized by their length, by the peculiar sensation under palpation, leaving an imprint under pressure; most of all, by the fact that they disappear with purgatives and enemas.

DISTENDED BLADDER causes symptoms of a tumor in the lower part of the abdomen, which fluctuates, and may readily be mistaken for an ovarian cyst. The suspicion is apparently confirmed by the history that the patient is passing urine in small quantities or that it is continually dribbling. This, however, should at once cause a suspicion of retention of urine and the introduction of a catheter by which the tumor is dispersed.

ASCITES.—With uncomplicated ovarian cysts diagnosis from ascites is not difficult. They have in common enlargement of the abdomen, fluctuation, and symptoms arising from pressure against the diaphragm. Both may be characterized by progressive loss of strength and flesh, more or less œdema of other parts of the body, and an enlarged abdomen. In ascites, the abdomen is more or less flattened, its widest diameter transverse, while an ovarian cyst is most prominent in the vertical diameter, and narrow from side to side. Fluctuation over the abdomen is very distinct in ascites and in unilocular ovarian cyst, but its wave extends nearer to the vertebræ in ascites. In the well-filled cyst the projection of the vertebræ prevents the approach of the fluid in the lumbar region. In multilocular cyst the wave is more broken and frequently is only recognized as a sensation of elasticity. Loss of strength is frequently greater in ascites, while emaciation is more marked in ovarian cyst. In renal and cardiac disease there is a greater disposition to anasarca. In very advanced and large ovarian tumor pressure may exist, and considerable dropsy of the

extremities, but the abdominal distension is in greater proportion. In palpation, ovarian tumor presents greater resistance, and the outline of the surface is more distinctly determined. The abdominal surface can be moved over it. Percussion affords the most valuable information, and ascites a distinct zone of resonance over the abdomen or part of greatest prominence, while the more dependent portions are dull. The zone of resonance changes with the position of the patient; in ovarian cyst, on the contrary, there is dullness upon percussion over the whole surface of the tumor—resonance only after we have passed beyond its limits, and the line of resonance does not change with the position of the patient. In tubercular peritonitis and in hepatic dropsy, where the mesentery has undergone contraction and the peritoneum is very much thickened, diagnosis can be so obscure as to require abdominal incision to determine it. Ascites may complicate an ovarian cyst. By displacement of a layer of fluid the hand will come in contact with the cyst. The amount of resistance will afford information as to whether the tumor is solid or cystic. Complication of a cyst by ascites should awaken suspicion of malignancy or some degenerative process. The greater the amount of ascites, the more probably the growth is malignant. The uterus is freely movable in ascites and ovarian cyst, displaced either downward and backward or upward and forward. In ascites arising from rupture of papillary cyst the recognition of a dense, thickened mass upon either side the uterus should cause a suspicion of its true character.

Second, is the tumor under our observation an ovarian growth? The physical signs vary with the size and situation of the tumor. In its early stage it is

entirely within the pelvis, and its position varies. When as large as a hen's egg it falls into the pelvis, where it remains until it attains a size which will no longer permit its accommodation in that situation. Its relation with the corresponding side of the uterus permits its determination by conjoined manipulation. Where the condition has been complicated by peritonitis, the diagnosis may be difficult. Fluctuation or even elasticity does not characterize the smaller growths. It is absent entirely in proliferating cystomata, in dermoids, and often even in single cysts. If we are unable to separate the tumor from the uterus and determine the existence of a pedicle, it can be accomplished by seizing the uterus with a vulsellum while the patient lies upon her back, and with two fingers in the rectum differentiate the borders of the uterus and the relation of the latter to the growth. In small growths the hand over the abdomen and finger in the rectum will generally enable us to outline them. Fibroid tumors of the uterus and inflammatory growths of the tubes are likely to be confused with small ovarian cysts. Tubal growths are pyosalpinx, hydrosalpinx, and hæmatosalpinx, the characteristics of which we have already discussed. In pyosalpinx the acute history, marked tenderness, existence of inflammatory exudation, and the matting together of the pelvic tissues should distinguish it. A hydrosalpinx is generally movable, gives a sensation of elasticity or of fluctuation, but the tumor is oblong and gourd-like, rather than spherical. A hæmatosalpinx is situated to one side of the uterus, is at first soft, but becomes harder from the coagulation of blood. In the large abdominal growths an ovarian cyst distends the abdomen, particularly at its lower part, rises abruptly from the pubes,



and is sharply defined and symmetrically developed. In large single cysts the surface will be smooth and regular, but, in the multilocular, projections and irregularities are found. When made up of a large number of small cysts, it will be more resistant, although it will still present a sensation of elasticity.

Large growths are confounded with pregnancy, hydramnios, extra-uterine gestation, uterine myomata, retroperitoneal growths, and tumors of the various viscera of the abdominal cavity.

**PREGNANCY.**—The enlargement of the abdomen is more rapid, is generally associated with suppression of menses, and the presence of sympathetic nervous phenomena, while in the more advanced stage the patient presents a florid, healthy appearance. Errors are more likely to occur in the unmarried during the early stage of pregnancy. The physician should not be hasty in expressing an opinion, so long as there is any reason for doubt. The examination a few weeks later will dispel uncertainty. As pregnancy advances, foetal movements, heart-sounds, and parts of the foetus are recognized. Foetal heart-sounds, when heard, are characteristic. Gestation in one horn of a bicornate uterus will make the diagnosis difficult, but a careful bimanual examination will demonstrate the association of the enlargement with the uterus. Under no circumstances should the size of the uterus be determined with the probe when there is the least suspicion of pregnancy.

**HYDRAMNIOS** is a pathological form of pregnancy in which a large collection of amniotic fluid occurs in the uterine cavity. When the collection exceeds two quarts upon examination for ovarian cyst, the history is of value. Hydramnios comes on suddenly, occurs about the sixth or seventh month of a pregnancy

which has previously run a normal course. The physical examination will disclose an enlarged uterus, cervix frequently obliterated, os open, covered with a dense membrane through which, by manipulation, we may distinguish the parts of the foetus or determine ballottement.

**EXTRA-UTERINE PREGNANCY.**—An ectopic gestation sufficiently large to permit it to be confused with an ovarian cyst will present the symptoms of an early pregnancy, possibly indications of rupture of the sac and internal hæmorrhage. In advanced stages foetal movements and heart-sounds will be heard. Vaginal palpation discloses the foetal parts covered with the thin wall. After death of the foetus changes will occur which render the diagnosis more difficult. The foetus shrinks, becomes macerated, decomposition in the sac occurs, which renders it resonant, while at the same time fluctuation is distinct. The diagnosis is determined by careful analysis of the subjective symptoms, associated with a thorough physical examination.

**UTERINE MYOMATA.**—Slow growth, resistance of the tumor, presence of multiple growths, irregular contour, and relation to the uterus afford confirmation in the diagnosis. The difficulty may be as great in œdematous fibroids and in fibrocystic tumors. Double ovarian cysts, particularly where the pedicle is short or absent, may so drag up the fundus uteri as to make it appear that they are a part of the organ itself. The relation of the uterus to the tumor is best determined by drawing down upon the cervix with a vulsellum, which is held by an assistant, while a second assistant draws up the tumor through the abdominal walls and simultaneously the operator with one or two fingers in the rectum, the hand over the abdomen,

seeks the pedicle and determines its relation to the uterus.

It is often impossible to distinguish fibroma of ovary from a pedunculated subserous uterine fibroid. Hegar's method of diagnosis is trustworthy; the finger is passed into the rectum, and pressed against the tumor, at the same time the uterus is drawn downward by a volsella. If the tumor be ovarian, it will not move; if uterine, there will be great resistance to drawing down the cervix, which will clearly be continuous with the morbid growth. True fibroma of the ovary often sets up ascites, yet is rarely adherent to adjacent structures. It is never invested by a distinct capsule, like a uterine myoma. It undergoes different kinds of degeneration, even malignant, contrary to the opinion of many observers. Barremano (*Ann. de l'Institut. de St. Anne, Bruxelles*, vol. ii, No. 98).

Third, the relation of the tumor to the surrounding parts, the character of the pedicle, and the presence of adhesions. The mobility of the tumor is dependent upon the length of its pedicle and the absence of adhesions. The tumor which can be pushed about without dragging upon the uterus and can be displaced from side to side, the abdominal wall sliding over it, is recognized as free from adhesions and having a long pedicle. Rapid enlargement, tenderness of the abdomen, sensation of crepitus as the abdominal wall is moved over the tumor, indicate recent and extensive adhesions from peritonitis. Limited adhesions of the omentum, intestine, and abdominal wall cannot be excluded.

Torsion of the pedicle is recognized by the onset of sudden and severe peritoneal symptoms, severe pain in the belly, meteorism, vomiting, and accelerated temperature. Rapid growth of the tumor and tenderness of its surface indicate that torsion has been followed by intracystic hæmorrhage or increased exudation.

Sudden collapse followed by symptoms of internal hæmorrhage and peritoneal irritation indicate the occurrence of hæmorrhage. Acute torsion is difficult to differentiate from rupture of an ovarian cyst, and peritonitis from perforation of the stomach or intestines, renal or gall-stone colic, ileus, and rupture of ectopic gestation. We can only arrive at a conclusion from careful investigation of the history.

Inflammation of the tumor is characterized by sensitiveness, radiating pain, sudden enlargement, or the suppuration lead to the formation of gas and the development of tympanitic resonance. Rupture of a cyst is recognized by sudden oppression, suffocation, nausea, sometimes vomiting, diarrhœa, acceleration of the pulse, moderate elevation of temperature, presence of free fluid in the peritoneal cavity, and indication of decrease in the size of the tumor, with strong diuresis. Tumor limits are indistinct and there is no alteration of resonance with the change of position.

**Diagnosis as to Varieties of Ovarian Tumor.**—The glandular proliferating cyst is the most frequent, and attains the largest size. They are mostly multilocular, and consequently present a less-marked wave of fluctuation. Fluctuation is an indication of its cystic character and is very distinct in the unilocular and large chambered cysts. Instead of fluctuation we not infrequently find elastic stretching which can be produced by œdematous, solid growths, and enlarged cysts whose contents are made up of colloid or very thick, viscid material. In fluctuating or tough, elastic tumors which are nodular we find a cystadenoma. A large fluctuating tumor is not necessarily a unilocular cyst; generally a small cyst which makes no symptoms is not a cystadenoma, but a dermoid or parovarian,



or, more probable still, a simple retention cyst of the ovary.

Papillary growths of the ovary are of three kinds—the true ovarian papilloma, the colloid papillary cystoma, and the papillary cystocarcinoma. A case of endothelioma also met with, taking the form of papillary excrescences in an ovarian cyst. The ovarian papillomata resemble each other in their naked-eye characters, in the formation of excrescences on the outer surface of the cyst-wall, in their implantation on the peritoneum, and in the concomitant existence of ascites; further, both are frequently bilateral and intraligamentary in nature. But the ovarian papilloma is to be distinguished by the following characters: it is quite benign; its epithelial proliferation never invades surrounding tissues in a destructive way; it grows slowly and does not occasion cachexia; and it does not cause typical metastatic growths. Generally papilloma retains its benign character, even when it has existed for several years. On the other hand, the papillary cystocarcinoma is from the beginning a true carcinoma, and not a papilloma with cancerous degeneration. The ovarian papilloma most often originates in the surface epithelium of the ovary. When extirpated, such a growth does not return; but the other ovary, even if apparently healthy, ought always to be removed also, for it will ultimately develop similar tumors. Oscar Semb (*Supp. Norsk Mag. f. Laegevid.*, Oct., '96).

Dermoid tumors are recognized by their irregular consistency, in some places soft and in others hard. The recognition that the tumor has been in existence for ten years or more will indicate a probable dermoid. Olshausen differentiates parovarian growths by moderate size, slow growth, thin, relaxed walls, light fluid contents, and very distinct fluctuation. Large cysts are generally multilocular.

Double intraligamentary growths and the presence of ascites with small tumors is a presumption of papillary growths,

but not a positive indication. Superficial papillomata feel firm, nodular, and often extend diffusely into the pelvis. A rapid-developing ascites in which renal, cardiac, and hepatic causes can be excluded, should, in the presence of bilateral resistance, awaken a suspicion of ruptured papillary ovarian cyst. Pronounced solid consistence of a growth is common to ovarian fibroid, sarcoma, endothelioma, carcinoma, and teratoma. An ascitic accumulation as a complication is a presumption of malignant trouble. Pronounced cachexia and marasmus may be produced by certain complications, as rupture, torsion, inflammation, also in tumors of normal size. Rapid growth especially speaks for malignancy. Olshausen directs attention to premature œdema of the legs as a symptom of cancer.

**Etiology.**—Various theories have been advanced as a cause for the development of ovarian tumors. Cohnheim believed them to originate from retained embryonic products. It was formerly supposed that the dermoid was thus derived, but the diversity of structure found in the dermoid, and especially in the teratoma, precludes the possibility of such origin and favors the assertion that they arise from ovum-cells which have been subjected to some special irritation. The variety of irritation, whether mechanical or chemical, animate or inanimate, differs in various kinds of tumors is as yet unknown. It is probable that it is chemical irritation which has proceeded by way of the uterus and tubes. Susceptibility for the acceptance of the tumor excitors varies in different individuals, in which the heredity, acquired disposition, age, trauma, scar-formation, and inflammation are important factors. Age has no special significance, though glandular cysts are more frequent between the

thirtieth and fiftieth years. All varieties are less frequent in childhood and old age. Ovarian growths are more frequent in the single than in the married.

**Course.**—Proliferating cysts grow more rapidly than either the dermoid or solid tumors unless the latter are malignant. A rapid increase in the size of a growth noticeable from day to day is due to hæmorrhage. When the pelvic structures are normal, an enlarged cystic ovary will drop by its weight into Douglas's pouch. As it increases in size, it advances in the direction of least resistance, which is upward, and pushes before it the intestines, when it will rise out of the pelvis and impinge against the abdominal wall. It then assumes a central position. The tumor lies directly above the uterus, rests on the brim of the pelvis, and causes but little inconvenience. Occasionally it may become impacted, because of irregularities in its growth or from extensive adhesions. The tumor rests upon the pelvis; as it advances it pushes the intestines upward and laterally. If undisturbed, the enlargement becomes so great that the diaphragm is pushed upward, severe pressure symptoms follow, and the action of the heart and lungs is obstructed. Marked suffering, emaciation, and the development of the characteristic facial expression known as *facies ovariana* follow. The presence of ovarian tumors does not interfere with ovulation and menstruation, even though both ovaries are involved, so long as ovarian stroma remains. Thornton reports a case of pregnancy with bilateral dermoid disease.

**Complications.**—Among the complications or ovarian tumors, ascites occurs infrequently with cystic growths, unless from rupture, but is very frequent in the solid. The cause is unknown; it may possibly arise from pressure upon

the vena cava or large veins. The œdema may enlarge one or both legs. The ureter and pelvis of the kidney may be dilated.

The most frequent complication is the formation of adhesions between the surface of the tumor, the omentum, the intestines, the uterus, the bladder, and the abdominal wall. These adhesions arise from inflammation, as in peritonitis. When not associated with inflammation they arise from loss of epithelium from the surface of the cyst, through friction. Adhesions may become dense, firm, often thread-like, and may convey large vessels between the omentum and growth. Adhesions are frequent in dermoid growths. When adhesions exist between the tumor and bladder, an opening may occur through which its contents are evacuated; openings also occur between the tumor and bowel. Adhesions are of importance because of the increased difficulty in the removal of the growth.

**TORSION OF THE PEDICLE** is a quite frequent complication. It is only when the alteration is sufficient to influence the circulation that it produces disturbance. The right-sided tumor turns to the left and the left-sided to the right. The cause of the torsion is unknown. Küstner ascribes it to peristalsis and the varying distension of the rectum; Carrio to sudden belly pressure; Mickwitz to contraction of the transversalis muscle. It is very frequent when associated with pregnancy; may occur also from injury. The twist may involve one or two turns of the pedicle, though as many as six twists have been observed. The tendency to torsion of the pedicle is favored by the existence of a long, membranous pedicle, spherical form of the tumor; still further by pregnancy, labor, and childbirth, through the changing relations of the organ in the abdominal cavity. Tor-



sion is the cause of obstruction of the vessels, in which the thin-walled veins suffer before the more resisting arteries. The pumping of blood into the tumor by the artery and its inability to escape by the vein gives rise to rapid increase in the size of the tumor. Fatal result can occur from hæmorrhage into the abdominal cavity. Hæmorrhage may be arrested, but the nutrition of the tumor suffers, its covering epithelium is lost, extensive adhesions follow between its surface and the omentum, intestines, and parietal peritoneum. Adhesions at first are very loose, subsequently become organized. The growth thereby obtains a new source of nutrition. Where the twisting of the pedicle is sufficient to obstruct the arteries, the entire circulation is cut off and necrosis of the growth results. Necrosis is followed by shrinking of the tumor and absorption of its fatty contents; peritonitis may follow, and extensive ascites exist. Peritonitis arising independently of micro-organisms is due to irritation from the presence of a foreign body or the chemical products of the tumor. Sometimes suppuration of the tumor and pyæmia ensue.

Personal case and twelve others from literature. In the author's case the inner wall of the cyst was studded with tubercles containing typical bacilli. No evidence of tubercular nodules or infiltration was found in the fibrous or serous layers or in the corresponding tube. In the broad ligament near the pedicle there were collections of leucocytes in the lymphatics, with giant cells. The writer infers that in this and in similar cases there is a secondary invasion of bacilli into the main cyst, usually from the infected tube, gut, or peritoneum. In all except the writer's case and one other the peritoneum was tuberculous. Prüssmann (Archiv. f. Gynäk., Band lxxviii, Heft 3, 1903).

Dermoid growths are occasionally found free in the abdominal cavity or

in pedicle-like adhesion with other structures. Ileus has resulted from adhesions of the intestines to the tumor or to the pedicle. Torsion infrequently may produce no symptoms. These are usually slight, and can be suspected when the patient suffers a severe pain associated with meteorism, sensibility to pressure, acceleration of the pulse, sometimes singultus, vomiting, and fever.

Thirteen cases of strangulated ovarian cysts met with out of a little over one hundred. It is important to recognize the condition early. If the twist occur suddenly symptoms are very characteristic. The woman, being previously in comfort, is suddenly seized with severe abdominal pain, sometimes sufficient to make her feel faint, and generally followed by some vomiting. There is a diffuse tenderness over the whole abdomen. The patient, if she knows that she has previously had a tumor, will note that coincident with the attack the tumor seemed to swell up and become hardened. On abdominal examination the tumor may be felt of a globular outline, but generally of not a very large size. It is tender on pressure and has a somewhat firmer feel than the majority of ovarian cysts. It can be moved from side to side. Occasionally some creaking can be heard and felt. *Per vaginam* the uterus is probably movable, and the tumor, if felt at all, is lying higher up, only resting on the brim of the pelvis. The general condition is one of distress. Pulse is rapid and the temperature more often raised than not. If the temperature is raised the prognosis is far more favorable than when the same symptoms are present with a normal or subnormal temperature. Symptoms resembling those of a twisted cyst may be due to a simple inflamed cyst, a ruptured cyst, an extra-uterine foetation, or an hæmatocele.

If symptoms be due to the rupture of a cyst there will be the same sudden symptoms as if a twist had occurred, but the outline of a twisted cyst is well defined, feels firm, and the tumor is somewhat larger than previously, while

in a ruptured cyst the outline of a tumor becomes indistinct and feels flaccid, is smaller, or even disappears, while there is dullness in the flanks from gravitation of the extravasated contents to these regions. When the symptoms are due to a ruptured extra-uterine foetation there will often be a history of missed, or at least irregular, periods. There may be suggestive signs about the breasts. Pain is more pronounced, while it is almost invariably accompanied by fainting and other symptoms of collapse. The anæmic condition of the tissues, soft, rapid pulse, and sighing respiration suggest bleeding, while an abdominal examination shows there is no definite tumor. These symptoms collectively can scarcely be mistaken for a twisted cyst. On the other hand, a limited hæmatocele into the broad ligament or into Douglas's pouch may closely resemble a twisted cyst. In such a case the tumor in Douglas's pouch and the fixing of the uterus should have suggested the nature of the case. If a twisted cyst is not diagnosed early the symptoms may rapidly pass on into those of acute peritonitis, and, owing to the distension of the intestines disguising the cyst, the diagnosis is obscure. Directly the nature of the case is suspected the abdomen should be opened and the cyst removed. Harrison Cripps (*Lancet*, Feb. 15, '96).

Ovarian tumor, if acute torsion be present, shows an hæmorrhagic or pink surface, with a certain amount of surface œdema. The symptoms usually come on suddenly, with a feeling of something displaced in the abdomen. The pain is at first localized over the affected ovary, but rapidly becomes general, extending into the loins and down the thigh on the affected side. Vomiting is an early symptom. At first it is mucous, and later becomes green. Abdominal respiration is suppressed. There is constipation, often almost complete. The face is usually somewhat drawn and pinched. The pulse is small and quick, and the temperature rises one or two degrees. Death may occur from various causes if speedy help be not given. Acute peritonitis may ensue, or hæmorrhage into the tumor, which may

be followed by rupture. If the patient survives the acute stage, chronic peritonitis, with the formation of numerous adhesions of the cyst-wall to the abdominal viscera, often follows. Sometimes the cyst may suppurate. Chan-delux (*Soc. de Chir. de Lyon; La Gynéc.*, June, '98).

Two conditions are essential to the production of a torsion of the pedicle of an ovarian tumor: a long, slender pedicle, and a small tumor, not larger than a fist, or at most a cocoa-nut. The size of the tumor when removed does not indicate its size when torsion occurred; for it grows with each twist. The torsion may be either gradual or sudden, either partial or total. The pedicle may be twisted once on itself or many times, until it has become so thin as to appear on the point of breaking. Salient features in diagnosis of a twisted ovarian pedicle are: moderate distension of the subumbilical region, with greater prominence either in the median line or on either side; rapid formation of swelling, which perhaps was merely noticed before; more or less tenderness on pressure; tense but distinct fluctuation, with single or interrupted wave according as cyst is single or multilocular; outline of swelling generally distinct, but sometimes diffuse; dullness on percussion over area of swelling; tumor touchable through anterior vaginal vault, and continuous with suprapubic swelling; uterus generally posterior to vaginal swelling; fluctuation-wave in vagina continuous with abdominal wave; temperature somewhat elevated, perhaps to 102°; pulse rapid and small; general depression; anxious countenance. P. F. Mundé (*N. Y. Med. Jour.*, Feb. 25, '99).

Series of 30 cases collected and 2 personal ones, in 26 of which torsion occurred during pregnancy. The cause of the accident was discoverable in only 2, while in only 3 was the diagnosis certainly made before operation. It does not seem to occur with ovarian tumors. Petritschek (*Inaug. Dis.; Centralb. f. Gynäk.*, No. 26, 1900).

INFLAMMATION AND SUPPURATION of the cyst is a complication which may



occur, though much less frequently than formerly, when puncture of the cyst was often practiced. Infection may extend by the uterus and tube, or by intestine, particularly where adhesions occur between the latter and the sac. Dermoid tumors are inclined to suppurate, probably as a result of injuries which they undergo during their long duration in the body. The occurrence of inflammation and suppuration is indicated by fever, which varies in intensity according to the extent of infection. The patient experiences but little pain, unless peritonitis is associated. Adhesions to the suppurating tumor may occur and the pus make its exit to the bladder, rectum, or vagina. It is rarely that it is completely evacuated and spontaneous recovery follows. Death usually occurs from pyæmia. Rupture into the peritoneal cavity is rapidly followed by fatal peritonitis. Such a tumor opening into the bladder produces the greatest distress, as hair, teeth, and pieces of bone are thus discharged, sloughs are impacted in the urethra, inducing cystitis, retention of urine, and marked vesical tenesmus. Fragments, when retained in the bladder and coated over with salts, form the nuclei of calculi.

**RUPTURE OF CYSTIC TUMORS.**—The rupture may occur suddenly as a result of a fall or blow, or gradually from changes in the cyst-wall. In papillary growths the pressure of the vegetation causes thinning of the cyst-wall, and finally rupture, or the growths extend through the wall of the cyst and on its external surface. Rupture of the cyst can occur into the surrounding viscera, but more frequently into the peritoneal cavity; in thin-walled cyst occurs easily under manipulation to determine the diagnosis, change of position in bed, the act of coition, or vomiting, and occa-

sionally occurs without assignable cause. The effect of the accident will depend upon the character of the cyst-contents. In unilocular cysts no untoward symptom occurs beyond excessive flow of pale urine. In single parovarian cysts recovery may follow the rupture. Generally, however, the opening closes and the fluid reaccumulates. In rare cases it is followed by high temperature, rapid pulse, vomiting, pressure at stool, and diarrhœa, which indicate the condition of the contents: a kind of autointoxication. In multilocular and dermoid growths rupture into the peritoneal cavity is often followed by infection, rapidly developing peritonitis, and finally death. Rupture of papillary cysts results in infection of the peritoneum and the formation of ascites. Vegetations spring up over the entire cavity. Sometimes an artery is torn in the rupture, and marked hæmorrhage with profound anæmia follows. The occurrence of rupture is recognized by disappearance of the tumor, diminution of its size, recognition of free fluid in the peritoneal cavity, peritonitis, collapse, diarrhœa, and diuresis.

Rupture of ovarian cysts divided into spontaneous and traumatic. One hundred and eight collected cases of the latter variety may be further subdivided into ruptures—due to movements of the body as a whole, 30 per cent.; and due to direct trauma, 70 per cent. Cases the result of torsion or parturition are not included.

Of the 70 caused by direct traumatic influences, 34 were the result of falls and 10 occurred during examination. Fate of the patient in 75 cases unoperated upon shows a mortality of 32 per cent., 8 of these being immediate, probably as the result of shock or hæmorrhage, while in 16 others the ultimate death from peritonitis was the result of the rupture. Mortality from traumatic rupture is thus somewhat lower than the average of mixed spontaneous and traumatic ruptures (41 per cent.), the spontaneous be-

ing specially prone to give rise to peritonitis, from their more complex contents. Twenty-six per cent. of cases recovered after more or less peritonitis, while 44 per cent. showed absolutely no symptoms of peritonitis; many of these were probably parovarian.

Clinical difference between traumatic and spontaneous rupture is chiefly to be found in the sudden outpouring of a much larger quantity of fluid into the peritoneal cavity. The initial pain varies from agony to such slight discomfort that the patient is almost unaware of the injury. The subsequent fate depends greatly on the character of the escaped fluid. In 9 instances the tumor did not return. Fatal hæmorrhage was found to be rare, though doubtless, from the symptoms so closely resembling shock, this may have been overlooked. Recently several cases have been reported, in which the urine showed the presence of peptones after a rupture. Storer (Boston Med. and Surg. Jour., vol. cxxxv, No. 21).

Ovarian tumor may be complicated with PREGNANCY. It is more frequent in the one-sided, though it may occur in the double-sided ovarian tumor. It can occur with any variety of tumor, though more likely to complicate the slow-growing formations. Numerous cases are recorded where the person carrying an ovarian tumor has run successfully the gauntlet of several pregnancies. The ovarian tumor does not grow so rapidly in pregnancy as does the fibroid. The occurrence of pregnancy will depend upon the size of the tumor. Very large tumors may, with increased size from pregnancy, cause marked dyspnœa, requiring interference. The influence upon the labor will depend upon the situation of the growth. The very large growths interfere with uterine contraction, and especially the voluntary assistance. If the tumor rests above the uterus and presses it down in a position of retroversion, or retroflexion, it may

cause impaction and finally abortion. A tumor situated in the pelvis below the uterus interferes with delivery, and unless it can be displaced its size must be reduced.

Case of a woman subjected to double oöphorectomy who soon after the operation began to menstruate and continued to do so regularly and painlessly for four months. Fourteen months after the operation she was delivered of a healthy girl, who died, however, three weeks later. Soon after this the patient again menstruated and has continued to do so regularly since. M. A. Morris (Boston Med. and Surg. Jour., Jan. 24, 1901).

An investigation on the relationship between ovulation and menstruation has shown that menstruation is no integral part of ovulation, nor an absolute factor of conception, though these two conditions are usually concurrent and attendant. There may, however, be ovulation without menstruation, and menstruation without ovulation, and conception without menstruation. C. C. Thayer (Jour. Amer. Med. Assoc., Feb. 9, 1901).

DEGENERATIVE CHANGES IN THE CYST-WALLS.—The cyst-walls can undergo the following degenerative processes: First, calcification; second, fatty degeneration; third, atheromatous changes; fourth, changes due to infarctions.

Treatment.—No other treatment is now recognized as worthy of consideration in the treatment of ovarian cysts other than their extirpation. Puncture or paracentesis was formerly an accepted procedure, but experience has disclosed that it is attended with danger. It is but palliative, and presents the possibility of puncture of a large vessel in the tumor-wall, with consequent hæmorrhage; infection of the peritoneal cavity by escape of the contents of a papillary cyst or colloid material, infection with the cyst followed



by inflammation and suppuration, are possibilities which should preclude the practice of this procedure.

**OVARIOTOMY.**—Extirpation of the tumor is known as ovariectomy. Success in its performance will depend upon the care with which the diagnosis has been made, the knowledge the operator has as to the condition of the patient, his dexterity in the performance of the operation, and judicious treatment subsequently.

*Indications.*—It was formerly a rule that patients should not be subjected to an operation until the tumor attained to such size that the patient was beginning to suffer inconvenience from the distension. The introduction of the principles of antiseptic and asepsis have rendered such postponement unnecessary.

The large proportion of tumors in which malignant complications result, the danger from injury of the growth and torsion of its pedicle, indicate the necessity for early operation.

Conclusions based upon an analysis of 85 cases of diseases of uterine appendages: 1. It is advisable to do conservative operations in all cases in which the ovaries and tubes are not hopelessly diseased in all parts of their structure, except on patients who are near the menopause, on patients who have pronounced gonorrhœa of long standing, and on the rare cases of malignant disease. 2. When a patient is near the menopause (over thirty-five years of age) and has ovarian or tubal disease of any considerable degree of severity it is generally wiser to perform complete removal with or without hysterectomy, according as the uterus also is diseased or not. 3. In cases of well-marked gonorrhœa of long standing, especially if the patient is constantly exposed to infection, if both tubes are seriously diseased and closed, total removal with or without hysterectomy is the operation of choice. 4. In certain cases of this class in which the

patient thoroughly understands the likelihood that another operation may be necessary at some future time and wishes to take the chances in the hope of preserving the function of menstruation, conservative operation is permissible. 5. If one tube is patent and healthy in appearance and there is enough healthy ovarian tissue to preserve, a conservative operation ought to be performed even in the presence of gonorrhœa. 6. With present methods of performing resection of the tubes, if both tubes are found closed at the time of operation, subsequent pregnancy is not to be expected. 7. In severe grades of inflammation of the appendages irrespective of causation, if the ostium abdominale of one tube is patent the prospect of subsequent pregnancy after the preservation of a portion of ovary is about one in four and a quarter, or 23½ per cent. 8. In the less severe grades of inflammation under similar conditions of tube and ovary the prospect of subsequent pregnancy is about one in two and a quarter, or 44 per cent. 9. In women who have borne children, in both classes, subsequent pregnancy may be expected in 35 per cent., whereas in previously sterile women it may be looked for in only 5 per cent. 10. If it is necessary to remove both ovaries it is of no advantage to preserve any portion of tubal tissue, but, except under the conditions just enumerated, some ovarian tissue should be preserved in every case. W. L. Burrage (*Annals of Gynec. and Pæd.*, May, 1900).

Ten cases of ovariectomy during pregnancy, followed in four instances by abortion; all the patients recovered. Series of 148 cases of pregnancy complicated by ovarian tumors also collected. The mortality had been 2.7 per cent., while in 22.5 per cent. the pregnancy had been interrupted. In such cases the writer concurs with other authorities that ovariectomy should be performed as early as possible. Orgler (*Archiv f. Gynäk.*, Bd. lxx, SS. 126-160, 1902).

*Operation.*—The operation consists in: first, the incision of the abdominal wall; second, puncture of the cyst and separation of adhesions; third, ligation of the

pedicle and removal of the cyst; fourth, exploration of the remaining ovary and toilet of the peritoneum; fifth, drainage; sixth, closure of the wound; seventh, dressing. The abdominal incision is made in the median line about three inches in length midway between the umbilicus and symphysis. Incision is made through skin, superficial fascia aponeurosis, and deep fascia to the peritoneum. It is generally aimed to make this incision through the linea alba, but in undilated abdominal walls the separation may be so slight as to render it difficult. The sheath of the rectus muscle is opened from the side; the incision should extend through the muscle, as its injury is immaterial. Bleeding vessels are secured before the peritoneum is opened; it is then picked up and incised between forceps so as to avoid injuring the sac or a knuckle of intestine which may be situated in front of it. With the completion of the incision, the pearly-white sac is exposed. It may be explored by introducing the hand, passing it around the tumor, thus recognizing the presence or absence of adhesions. With an assistant pressing the sac firmly against the wall, a trocar to which a long rubber tube is attached may be plunged into the tumor and the fluid carried into a vessel at the side of the table. In the absence of the trocar an ordinary glass syringe-nozzle can be utilized. Incision is made with the knife into the tumor-wall and then the syringe-nozzle introduced. The assistant presses the tumor down against the abdominal wall, and keeps it tense. As the fluid is discharged the sac becomes relaxed. It should be seized with hæmostats or cyst-forceps and drawn out so that the opening is kept outside the peritoneal cavity, to prevent its being soiled with the tumor-contents. As the sac is drawn out,

the adhesions are separated; those which are recent and soft may be overcome by pressing against them with a sponge or gauze pad. In this way the adherent intestines are sponged away from the cyst. Where the adhesions are old and firm, they require scissors or knife to accomplish their separation. Bleeding vessels in these adhesions should be secured with hæmostat or immediately ligated. Where the adhesions are very firm and short, so that the intestine lies directly upon the tumor-wall, separation will frequently be attended with marked injury to intestine. To prevent this, a portion of the sac-wall should be permitted to remain in contact with the intestine, taking the precaution to strip off from it the secreting surface. The adhesions should be as far as possible separated under the eye, keeping a watch for large vessels and avoiding injury to intestines, and particularly to the spleen and liver. Vascular adhesions in the omentum should be at once secured either by clamp-forceps or ligature.

*Ligation of the Pedicle and Removal of the Cyst.*—Ligation may be accomplished with silk or catgut, preferably the latter. In a long, slender pedicle it is transfixed in the centre, ligated in two portions. Thicker, shorter pedicles, may be ligated in several sections or it may cut through the pedicle, using clamp-forceps to secure it and ligate the vessels separately. After ligation of the principal vessels clamp-forceps are removed and the surfaces carefully observed for further bleeding. In these cases the peritoneum is sutured over the raw surface. Where the pedicle is ligated in sections the sutures should be interlocked to prevent their tearing below, which might cause serious bleeding. In large cysts, for the withdrawal of the cyst the pedicle is seized



with clamp-forceps and the cyst cut away as a preliminary to the ligation.

Having secured the pedicle we proceed to the investigation of the other ovary and the toilet of the peritoneum. The investigation of the remaining ovary is important for the reason that not infrequently a smaller cyst is found in it which will be readily overlooked and which will necessitate a subsequent operation were this investigation omitted. Where a cyst of considerable size exists, the ovary should be removed. Smaller cysts in the ovarian diseased structure may be resected or the cysts may be punctured with a thermocautery. Where the ovary can be saved it should be done. We now proceed to the thorough investigation of the peritoneal cavity, looking over the points at which separation has taken place, in order to make sure that no vessels of large size are bleeding. Instead of spending time, however, in sponging out the blood, the better plan of procedure is to irrigate the cavity with a large quantity of normal salt solution. If there are no bleeding vessels of size, the cavity may be filled up with this fluid and the wound closed. All bleeding vessels, however, should be secured by ligature.

In operations on ovarian cysts and cystic ovaries any portion of ovarian tissue which appears normal, even though small, should be retained; resection and plastic operations should be practiced on women when pregnancy is liable to occur, and delivery at term can be conducted with safety. In two cases of adherent and retroverted uterus with enlarged, prolapsed, and cystic ovaries, the cysts were excised from the glands, and the cut edges sutured with fine silk, the result in both being equally satisfactory. In one, a woman 35 years of age, there was disappearance of all pelvic symptoms; in the other menstruation followed without pain or other morbid

symptoms. J. C. Stinson (*Occidental Med. Times*, Oct., '97).

Pozzi regards retention of a certain portion of ovarian tissue as of great importance, as in this way menstruation is often conserved. Indications for resection are found in benign cysts. In proliferating cysts there is danger of malignancy, and the clinical symptoms of malignancy should receive due weight. If both ovaries are affected and there is a probability of malignancy, total extirpation should be done. If the disease is malignant and confined to one side, the removal of ovaries is justifiable. In cases of chronic ovaritis the almost complete integrity is a necessary condition in deciding on the preservation of the ovaries. Advanced sclerosis calls for complete removal. Partial operation is indicated in: (a) Follicular cysts of the ovaries. Provided that the tube is sound and that part of the ovary is healthy, resection of the cysts is sufficient, and part of the ovary may be left behind. (b) Cysts of the corpus luteum. Their presence does not necessarily imply total degeneration of the organ, and as a rule preservation of a healthy portion is possible. (c) Sclerocystic or microcystic ovaritis characterized by the presence of numerous small cysts which exist independently from lesions of the tubes. Hunter Robb (*Cleveland Med. Gaz.*, Dec., '97).

Results of operations for malignant neoplasms of ovary at the Würzburg Clinic during seven years: 55 out of 239 cases of ovarian tumor, including papillomatous cysts, were malignant. Of these, 23 were inoperable; 16 of the 32 in which an operation was performed were cancerous, 8 patients succumbing to the operation. Recurrence occurred in 3 instances, 20 per cent. of the patients being cured; 81.8 per cent. of the cases of papillomatous cyst had no recurrence, and 2 patients died. Total percentage of cures in all cases was 46.8 per cent. Geyer (*Inaug. Dis.; Centralb. f. Gynäk.*, No. 32, '98).

From study of many cases treated by the several methods of operation, the following conclusions are drawn: 1. That an irreparably damaged tube, ovary, etc.,

should be removed by enucleation, with ligation of vessels only, using only absorbable ligatures. 2. That enucleation is the simplest, safest, and most scientific and æsthetic method of removing an ovarian cyst, tumor, etc., of the ovary, the tube, the uterus, etc. There is no danger of hæmorrhage; if a vessel is severed it can be caught at once and ligated. J. Coplin Stinson (Canada *Lancet*, Jan., '99).

In ovariectomy if the opposite ovary contains only a few retention-cysts it may be left after puncturing or resecting the cysts. If the cyst is of the true papillomatous variety the other ovary should always be removed, even if it appears to be perfectly healthy, since experience has shown that it often undergoes papillomatous degeneration afterward. This does not refer to cases in which small excrescences are found in the inner walls of retention or parovarian cysts. Commencing adenomatous degeneration of the opposite ovary may be suspected if the albuginea is much thickened and the organ is almost entirely transformed into large cysts with thick walls. In the case of young women a suspicious ovary may be split open, its interior examined, and, if healthy, may be sutured with catgut. If one ovary is affected with carcinoma, sarcoma, or endothelioma, the opposite one should always be extirpated. Theilhaber (*Brit. Med. Jour.*, Jan. 28, '99).

In cases of small ovarian cysts an attempt should be made to save a small portion of healthy stroma. Under no circumstances should an ovary be spared when the opposite one is the seat of carcinoma, papillary cystoma, or superficial papilloma, even when the organ is apparently perfectly healthy. Gersung (*Centralb. f. Gynäk.*, No. 5, '99).

Statistics of 394 ovariectomies performed in fifteen years in Schauta's wards, as early as possible and removing the tumor undiminished in size whenever it could be managed. Silk was employed and the abdominal wound closed in three layers. The mortality was 9.5 per cent.; of the recoveries, 97 per cent. were permanently cured and 76 per cent. had sound abdominal cicatrices. Removal

through the vagina resorted to whenever practicable; however, of the last 60 vaginal ovariectomies, the tumor could be totally extirpated only in 19; in 10 this method had to be given up and the abdominal operation performed. The mortality of the purely vaginal operations was 1.94 per cent. only. Burger (*Festschrift f. Prof. Schauta; Monats. f. Geburtsh. u. Gynäk.; Brit. Med. Jour.*, Nov. 17, 1900).

*Drainage.*—The question of drainage is not considered as one of so great importance as a few years ago. Then it was the custom to drain in the majority of cases; now, to drain in a very slight minority. It is only in those patients in whom there is extensive tearing up of the peritoneum, with the probability of oozing or serous effusion, that the operator would consider it necessary to drain. Drainage may be accomplished by the introduction of a glass drainage-tube, which must be carefully attended to for the next forty-eight hours, or the use of gauze drain, which serves a useful purpose, in that it may be employed to compress a large bleeding surface. In cases in which there is large tearing up of the peritoneal cavity, the plan advocated by Clark, of elevating the foot of the bed so that the fluid shall no longer be retained in the pelvis, where the peritoneum is most injured, but be thrown back into the peritoneal cavity, where it should come in contact with healthy peritoneum capable of absorbing it, is the method of procedure practiced in preference to drainage. It has received the name of postural drainage. This method of treatment has an advantage, also, in relieving the patient of much pain and discomfort, arising from the gravitation of fluid to the most dependent portion. The elevation of the injured part renders it more difficult for blood to be sent into it, and consequently the patient suffers less distress.



*Closure of the Wound.*—The principle of closing the wound is to bring and retain the various parts of the wound in their normal relation. This is effectively accomplished by employing both interrupted and continuous suture, introducing a continuous suture with catgut to close the peritoneum, then introducing a series of interrupted silk-worm-gut sutures which shall pass through the abdominal walls, and pick up the edge of the peritoneum. The placing of these sutures is followed by a continuous catgut suture uniting the aponeurosis of the wall. The tying of the interrupted sutures holds the surfaces in apposition, prevents the accumulation of fluid in any dead space, and permits the sutures to be tied only sufficiently tight to hold in apposition the surfaces.

*Dressing.*—After careful cleansing of the surface the wound dressing consists in placing a piece of gauze wet with 1 to 2000 bichloride solution around the sutures, and over this several layers of sterile gauze and cotton, which are held in place by tapes attached to pieces of plaster and fastened on either side of the dressing; and, finally, a well-placed bandage.

*After-treatment.*—The patient is kept quiet in bed, carefully moved from side to side to render her detention less irksome. Until she recovers from the anæsthetic, she is given nothing by the mouth other than small quantities of hot water, concentrated beef-extracts, and at the end of twenty-four hours, in an ordinary case, may be given a cup of tea and a little soft toast. This is followed later with an egg, chewing some beefsteak, and at the end of the third day a light diet.

Any indication of accumulation of gas in the intestine is early relieved by the administration of an enema consist-

ing of an ounce each of magnesia, glycerin, and water. This failing to afford relief, is followed by a large enema of soap-suds in which an ounce of turpentine beaten up with the yolk of a couple of eggs, and strained, or an ounce of tincture of asafoetida may be substituted for the turpentine. Nausea and vomiting may be overcome by giving draughts of hot water, thus washing out the stomach; the administration of small doses, frequently repeated, of tincture of nuxvomica, or a combination of acetanilid and caffeine, or the use of oxalate of cerium. If the patient regurgitates small quantities of dark-greenish material, and this is continued in spite of the large draughts of hot water, the stomach-tube should be introduced and the stomach irrigated. The patient should be carefully watched during the operation by both nurse and physician to anticipate the appearance of complications or abnormal symptoms.

The summing up of the testimony of the various experimenters seems to indicate that a properly transplanted ovary may continue to perform its full normal function and that one may not only expect to prevent the symptoms of the menopause after a patient's ovaries have been removed, but may reasonably expect a pregnancy in a certain percentage of cases. Personally there is little doubt that the recorded cases of pregnancy after double ovariectomy are cases of pregnancy from accidental ovarian grafting, a portion of ovary having remained on the distal side of the ligature, with establishment of adhesion circulation or contact circulation.

It is important to determine now just what method of ovarian transplantation gives the best opportunity for the ovary to continue its function. In all probability, a certain proportion of the women whose ovaries have been removed in the past could have had ovarian grafting done, either from a piece of remaining

healthy ovary or from a segment of an ovary from another patient, the operations having been so timed that the one who was to furnish the ovary could have been operated upon at the same *séance* with the one who was to receive the ovary.

The special dangers to be anticipated from ovarian grafting would seem to be no more than the dangers from simple uncomplicated laparotomy.

The ovary that is to serve for a graft is placed in a basin of physiological saline solution at a temperature of about 100° F. immediately on its removal. The broad ligament is the preferred site for grafting, as nearly as possible at the point that the ovary would normally occupy. One of pregnancy followed which was terminated by early abortion, but the several successful pregnancies that have been obtained in rabbits by other experimenters indicate that fruitful pregnancy in women as a result of ovarian grafting may yet be hoped for. R. T. Morris (Med. Record, Jan. 19, 1901).

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## UTERUS, DISEASES OF.

### Malformations.

**ABSENCE OF THE UTERUS.**—The uterus is seldom entirely absent in the living being, a slight rudiment nearly always being found at the post-mortem examination, although it may not have been discovered during life.

**RUDIMENTARY UTERUS.**—The rudimentary uterus may be of any size from a cylinder-shaped body an inch long down to a slight thickening of tissue on the posterior surface of the bladder at the junction of the rudimentary Fallopian tubes. It is usually solid, although in rare instances it takes the shape of a membranous sac. One or both ovaries may be present, usually also in a rudimentary state. The vagina may be developed, but is ordinarily represented by

a shallow, blind pouch. The vulva is apt to be normal in appearance.

About the end of the eighth week of foetal life Mueller's ducts begin to unite, the united lower portions forming the uterus and vagina, the upper ununited portions the Fallopian tubes. As a result of interference with the development during the process of union, which is complete at the end of the third month, various malformations have been found:

The **ONE-HORNED UTERUS** indicates an arrested development of one of Mueller's ducts. The organ is more or less fusiform in shape, and curves toward the corresponding Fallopian tube. The other side is usually represented by a rudimentary horn.

The **TWO-HORNED UTERUS** represents a want of perfect union of the ducts. The defect may involve the fundus only or may cause a flattening (uterus planifundus) or slight depression of the fundus, or it may extend downward any distance toward the cervix (uterus bicornis unicollis), or it may extend into the cervix (uterus bicornis bicollis). Sometimes a septum divides the uterus (and sometimes the vagina) below the junction.

The **DOUBLE UTERUS** results when the union of Mueller's ducts does not take place above the vagina. The two sides are entirely distinct, but the vagina may be single or double or septate.

The **TWO-CHAMBERED UTERUS** is more or less normal in size and shape, but the septum persists, and may not extend as far down as the internal os (uterus subseptus), or it may divide the whole uterus and cervix, forming two cavities, or the septum may extend to the internal os only (uterus septus unicollis).

**Symptoms and Diagnosis.**—The symptoms do not usually attract attention until puberty or marriage, when dysmenorrhœa, amenorrhœa, sterility, dyspa-



reunia, or the signs and symptoms of atresia of the vagina, with retention, develop.

The shape and size of the uterus is determined best by the bimanual recto-abdominal examination. If the vagina and cervix be well developed, the cervix can be pulled down within better reach by a vulsellum, and the character of the interior of the uterus may also be determined approximately by the sound.

If the diagnosis be difficult, it may be possible, with the aid of anæsthesia, to introduce a finger into the bladder; then the uterus, tubes, and ovaries can be palpated between it and a finger of the other hand in the rectum. When the uterus is rudimentary, slightly resisting cords, representing the Fallopian tubes, can be felt, which are joined at the site of the uterus on the posterior surface of the bladder and lead outward to the rudimentary ovaries, if such exist. If the uterus be one-horned, its fusiform shape can be palpated, extending laterally upward, and also the rudimentary horn on the opposite side. The two-horned uterus is easily recognized by the depression in the fundus, and the double uterus by the presence of two elongated hard bodies merging together in the vagina below.

*Treatment.*—There is but little to do in the way of developing the organ or improving its shape, and irremediable symptoms may call for removal of the ovaries or uterus or both. Pregnancy in a rudimentary horn usually eventuates in rupture, and calls for a removal of the affected part.

After the complete union of Mueller's ducts the following deformities may result:—

**Fœtal Uterus.**—The fœtal characteristics remain. The body is small and cylindrical, and may be solid. The cer-

vix measures about one inch, and twice as long as the uterus. The papillary folds of the cervix extend throughout the cavity.

**INFANTILE UTERUS.**—The uterus remains about the same as at birth. The body is but little over half the length of the cervix. The vaginal portion of the cervix is short, and the vagina and external genitals are usually small.

**PUERILE UTERUS.**—Here the body is as long or a little longer than the cervix, and the external genitals small. The conditions previous to puberty persist.

**PUERILE CERVIX.**—The corpus is about normal in size, but the cervix is small and conical, with an extremely small external os. Antelexion and stenosis may be present.

The *symptoms* and *diagnosis* are the same as for deformities, resulting from imperfect union of Mueller's duct, and may be associated with those of atresia vaginæ, or stenosis of the cervix (*q. v.*).

The prognosis is unfavorable except for puerile cervix.

*Treatment.*—If treatment is commenced soon after puberty, some benefit may be derived from intra-uterine bipolar faradization and persistent periodical dilatation of the cervix. Divulsion by means of bladed dilators under anæsthesia, with packing of the uterus for thirty-six hours, may be followed by repeated packings, provided the endometrium is douched out each time with an efficient antiseptic; afterward the cervix may be kept dilated by conical round dilators twice weekly. Pelvic massage and movements adapted to develop the pelvic musculature and increase the flow of blood to the pelvis are sometimes used.

**Stenosis of the Cervix.**—Stenosis of the cervix consists in a lack of development or atrophy of the part sufficient to interfere with uterine drainage. The con-

traction may be at the external or internal os, or exceptionally throughout the canal, and is often connected with flexion of the uterus. It may be due to puerility in the nullipara, to cicatricial contraction following cervical laceration in the parous woman, and to atrophy in the senile woman.

**SYMPTOMS.**—Colicky dysmenorrhœa, as in cases of ante flexion, lasting from a few hours to a day or two, is the most common symptom. Colicky pains in the vesical region are sometimes felt between the menstrual periods, and may be followed by a discharge of mucus, blood, or pus. In old people prolonged retention of secretions, which usually become offensive and purulent (senile endometritis), may take place and stretch the uterine walls until the organ resembles a bag. Endometritis with its symptoms is present in long-standing cases.

Sterility, which is often relieved by a dilatation of the cervix, is a common condition.

**DIAGNOSIS.**—If the stenosis is at the external os, the orifice may be scarcely visible, or may look like a small dimple on the end of the cervix. If at the internal os a small uterine probe, or a piece of slippery-elm bark cut into the shape of a slender tent, will demonstrate the partial or complete closure of the canal. If the cervix be small and flexed, the stenosis is probably connected with imperfect development and displacement; but if the cervix be large and perhaps lacerated, the stenosis is due to induration and contraction of the mucous and submucous tissues at or near the internal os. In the latter case the internal os is apt to be quite sensitive to the touch of the sound, and may bleed a trifle upon the withdrawal of the latter. Thick cervical mucus will, as a rule, be visible.

**PROGNOSIS.**—A state of patency of the cervical canal can usually be obtained, but it is often difficult to maintain it in the virgin and the old woman without occasional dilatation. The sterility can usually be relieved in quite young people; but, after the condition has lasted long enough to produce hyperplasia or endometritis, the sterility is apt to persist. In married women with stenosis and sterility, who do not apply for several years for treatment, the sterility is seldom relieved by dilatation, whereas it often is in the young married woman who applies within a year or two of the date of her marriage.

**TREATMENT.**—In ordinary cases of partial stenosis presenting symptoms, and in young women with small cervix, dilatation with graded sounds twice weekly, the same as for urethral stricture, will cure stenosis of the *external* os in a short time. Stenosis of the *internal* os may require the dilatation twice weekly for three or four months, then once weekly for a year. The cervix is not only dilated, but stimulated to increased development. Before each dilatation the patient should take a vaginal douche, and the vaginal fornices and endometrium should be disinfected with a 5-per-cent. carbolic-acid solution through the speculum by the physician, and the uterine cavity should be disinfected by tincture of iodine, ichthyol, etc.

In old cases the cervix will probably require forcible dilatation by bladed dilators as well as a curettage for the endometritis. The uterine cavity and cervix should be packed tightly for twenty-four hours after the operation, and the cervix be kept dilated by the passage of a large sound or bougie (size of a No. 18 urethral sound, American scale) two or three times monthly for several months.



Incision of the cervical canal is almost never required, except for cicatricial contraction or rigid anteflexion. In the latter case incision of the posterior wall of the cervix in the median line to the vaginal junction (Marion Sims) and a doubling in of the ends so as to obliterate the raw surfaces (E. C. Dudley) may render the cure of the stenosis of the internal os easier.

The following plastic operation on the cervix has been devised in order to prevent recurrence of the stenosis after division of the external os cervicis. It consists of the preparation of flaps from the vaginal aspect of the cervix and implantation of them in the angles of the wound made by the division. In this way union of the sides of the angle of the wound is prevented, and the remainder of the cut surfaces are held apart until cicatrization has occurred. A. Rosner (Centralb. f. Gyn., Feb. 27, '97).

**Laceration of the Cervix.**—Lacerations of the cervix are ordinarily produced by abnormal conditions and influences that interfere with the natural course of labor, such as a proportionately-large head, a small or diseased cervix, malpresentation of the fœtus, premature rupture of the membranes, precipitate labor, artificial dilatation of the cervix, etc.

The unilateral and bilateral lacerations are the most common varieties, although posterior, anterior, multiple (stellate), diagonal, and annular lacerations occur. They may even extend into the vaginal vault.

**SYMPTOMS AND DIAGNOSIS.**—The symptoms are those of the inflammations and displacements. The fissures and flaps of the lacerated cervix can best be discovered by a digital examination, and by inspection with Sims's speculum. The bivalve speculum opens the fissures wide, and thus may deceive the eye as to their size or existence.

**PATHOLOGY.**—Many moderate lacerations heal by adhesion, although the majority of deep ones cicatrize and contract with a cicatricial plug in the angle. In quite a large proportion of cases mucous membrane seems to extend over the raw surfaces, and nothing abnormal but the fissure remains.

More or less infection of the wounds is apt to take place, with the consequent cervicitis, parametritis, perimetritis, and perhaps pelvic abscess. The infection may also spread to the cervical, corporeal, and tubal mucous membrane and to the ovary and pelvic peritoneum. As a result of the cervical endometritis, the mucous membrane becomes hyperplastic, and pushes the lower ends of the cervical flaps outward, producing eversion (ectropion). All varieties of cervical inflammation, erosion, and degeneration are found connected with and probably dependent for their origin upon the lacerations.

Retroversion and lateral displacements of the cervix may result from the cicatricial contraction that attends those extending into the vaginal vault, and other displacements and fixations may result from peritonitis.

**TREATMENT.**—Extensive lacerations should be sutured immediately after labor if the conditions are favorable. The cervix should be carefully pulled down to the vulva by means of a vulsellum, the shreds of tissue trimmed from the lacerated edges, and the wound-surfaces be united in their original relation to each other by hardened catgut sutures. If there is any doubt about the possibility of subsequent cleanliness, silk-worm-gut sutures, which will hold better, will give better results.

Old lacerations may require a few applications of carbolic acid, or other disinfectant and astringent, to the eroded

and hyperplastic mucous membrane, for the diseased surface can be much better treated before being turned into the cervix than after. To close the laceration before curing the cervical endometritis often results in making the symptoms worse.

*Emmet's Operation.*—A tenaculum is hooked into the lower, or distal, end of the cervix at one side of the fissure and the mucous or cicatricial surface of the latter cut off, commencing under the tenaculum and going up into the angle and beyond the cicatricial plug. The other side of the fissure may then be denuded from the angle down, or from below upward as on the first side. If the laceration is bilateral, the fissure on the other side is similarly denuded, and then both wounds are sutured with hardened catgut or silk-worm gut. It is well to place the first suture at the distal end of the flaps in order to insure symmetry. Two-per-cent.-carbolic-acid douches used twice daily keep the catgut hard and clean for a considerable time, and has a disinfectant action.

When the lacerations are bilateral or multiple and extensive, and the cervical follicles extensively diseased, it is not worth while to spend several months in an attempt at cure, for Schroeder's operation will remove the diseased mucous membrane and restore the shape of the part.

*Schroeder's operation* consists in lateral incisions through the cervix, or cicatricial plugs, on both sides as high up as may be necessary to expose all of the diseased cervical mucous membrane. The sides of the tears are denuded from these incisions down to the end of the cervix. Instead, now, of sewing up the parts, as in Emmet's method, the mucous membrane is dissected off between lines drawn across from the upper and

lower ends of the raw lateral surfaces. The lower ends of the cervical flaps are then folded in until the mucous membrane of the vaginal portion reaches that of the cervical cavity above the denudation, and are sutured to it. Then the wounds left on either side are trimmed, if necessary, and sutured so as to close the lateral fissures.

Before closing the cervix it is better to curette the uterus, thoroughly, if there be endometritis, and gently (for cleanliness), if there be none, and apply carbolic acid or tincture of iodine to the endometrium.

**Displacement of the Uterus.**—The uterus is normally located in the central and anterior portions of the pelvis. The cervix is suspended by the pelvic connective tissue (pubo-uterine, sacro-uterine, and broad ligaments) just behind and often a trifle to the left of the axis of the pelvic cavity. Its range of mobility is small. The corpus leans over the bladder in slight anteflexion, the flexure varying with the fullness of the bladder and rectum. The former, when it becomes distended, lifts the fundus and straightens the uterus, while the latter, when loaded with fæces, pushes the cervix forward and thereby increases the flexion.

The main factors which determine malposition are variations in the relative development of the pelvic organs and contiguous connective tissue, and in injuries or other factors that diminish, destroy, or modify the connective-tissue support. Alterations in the uterus from pathological conditions constitute another, although less important, cause.

**Etiology.**—When the uterus is poorly developed, or is developed late, the connective tissue about the rectum and vagina have relatively more than normal supporting power, and the uterus may



be held up at the pelvic brim in a position called *elevation*. This is the position of the rudimentary and foetal uterus. Or the uterus may be held forward by the abundant connective tissue at the base of the bladder in a position called *ante-position*. This is often the position of the puerile uterus. An imperfectly-developed vagina aids in maintaining this form of displacement. As the corpus uteri and pelvis grow, the connective tissue of the broad and sacro-uterine ligaments may, as the result of constipation, debility, hard work, etc., be wanting in tone and fail to support the cervix firmly. Then, when the uterus is pushed backward by the distended bladder, the round ligaments, which nearly always share the flabby and immature nature of the corpus, do not draw the fundus forward over the collapsing bladder, and the abdominal pressure may turn the temporarily retroposed organ back into *retroversion*, or, if the connective tissue about the cervix is firm enough to hold it in position, bend the corpus backward, producing *retroflexion*.

When, however, the sacro-uterine connective-tissue folds are normally strong, they draw the upper part of the cervix backward, so that retroversion cannot occur, while a short, imperfectly-developed foetal vagina may pull the vaginal portion forward and give rise to a *congenital ante-flexion*. The corpus is small, and the cervix may be elongated by the traction of the vagina.

When the vagina is well developed, the anterior wall is two and one-half inches long and the bladder connective tissue does not draw the cervix too far forward. In such cases, if the uterus develops late or remains small in an otherwise-vigorous girl, the cervix is apt to be drawn by the vigorous sacro-uterine folds backward and upward nearer the rectum and sa-

crum than normal, while the fundus is drawn by gravity, and pushed by abdominal pressure, downward in front of the cervix and becomes more than normally bent or ante-flexed. Some atrophy and shortening of the anterior uterine wall is likely to take place, because the filling bladder does not lift the fundus sufficiently to straighten the corpus, nor is the dorsal position — which under normal conditions would tend to bring the fundus backward — able to do so. The flexion then becomes *permanent*, or *irreducible*.

Thus it will be seen that many of the displacements of the uterus are errors in development due to the inheritance of an imperfect *physique*, or to modes of living in early life that fail to insure symmetrical development.

After puberty congestion and inflammations of the uterus and neighboring structures modify or perpetuate these conditions. Thus, a hardening or rigidity of the uterine tissue from hyperplasia may render the flexion permanent, or irreducible. As a result of the increased weight, and of relaxation in the sacro-uterine tissues, the cervix may be carried by abdominal pressure toward the vaginal outlet, and we would have *ante-position*. If the ante-flexion is a permanent one, we have both ante-flexion and ante-position; or if the sacro-uterine ligaments are greatly relaxed, the body of the uterus is tipped backward by the bladder and abdominal pressure and we have both *ante-flexion and retroversion*. If the uterine rigidity takes place as the result of puerperal metritis in an organ that had been ante-flexed, the flexion may be prevented from returning, and the corpus will tip forward without bending in the position called *anteversion*.

General relaxation of the pelvic connective tissue due to pelvic disease, gen-

eral debility, and increased intra-abdominal pressure from ascites or tumors allows the uterus to descend to the vaginal outlet, either with the uterine long axis in coincidence with the pelvic axis, constituting *prolapse*, or with the fundus lying in the *cul-de-sac* of Douglas, constituting prolapse and retroversion.

Injury, overstretching, laceration, and subsequent cicatricial contractions may, as they affect different parts, allow the cervix to sink toward the vaginal outlet, or draw the cervix from its normal location and cause the above-mentioned displacements in a previously-normal uterus.

Inflammation and exudates of the pelvic organs and pelvic peritoneum may fix the uterus in its malposition, or may push or draw it from a normal to an abnormal location. *Lateral positions or versions* are usually caused in this way, and often the posterior deviations.

The same conditions that cause prolapse may be followed by a partial or complete *protrusion* of the uterus through the vulva. When the conditions are those of relaxation the cervix protrudes first, and inverts the vagina. This is the mechanism in the virgin and nullipara. When protrusion results from lacerations about the vaginal outlet, the vagina appears first at the vulva, dragging the uterus after it. The bladder protrudes with the uterus, and occasionally the rectum.

When the uterus is fixed in the pelvis by adhesions the traction of the vagina upon the cervix is apt to produce elongation, and some hyperplasia, of the cervix, and only moderate descent of the fundus, thus giving rise to *prolapse*, or *protrusion, of the cervix*.

The uterine displacements which are of sufficient importance to require separate considerations are *anteflexion, ante-*

*version, retroflexion, retroversion, prolapse, and inversion.*

#### Anteflexion and Anteversion.

**Symptoms.**—The most common symptom of anteflexion is dysmenorrhœa, due to interference with the drainage and circulation of the uterus. The pain may commence with the first menstrual period or not until some years later. It is a cramping pain in the lower abdomen felt about the time the menstrual discharge appears, and if there be no complication ceases when the flow becomes well established: *i.e.*, from one to several hours. As, however, more or less uterine and ovarian congestion and hyperplasia gradually supervene, the pain, after a time, lasts longer and becomes more continuous. Soreness in the lower abdomen, iliac and lumbo-sacral regions may then persist throughout. Between the periods the symptoms are those of hyperplasia or endometritis.

In retroversion backache and the other symptoms of the inflammatory conditions that have caused the misplacement are present.

Examination of 411 patients to determine how many with retrodisplacements presented no symptoms referable to the condition. The normal position of the uterus is anteflexion. In 25 per cent. of the cases retrodisplacement was present without giving rise to any painful symptoms, retroflexion being only half as frequent as retroversion; hence the inference that retroversio flexio is a common condition requiring no treatment in itself. E. Schroeder (Zeit. f. Geb. und Gynäk., Bd. xliii, H. 3, 1901).

**Diagnosis.**—The diagnosis is made by the bimanual examination. When the uterus is in the front part of the pelvis, the fundus, which is often small, is felt over the anterior vaginal wall and the cervix turned toward the perineal body.

When the uterus is retroposed, as is usually the case when the parts are well



developed, the cervico-vaginal junction will be found well back in the pelvis, making an acute, instead of the normal right, angle anteriorly. With the tip of the index finger touching the junction of the cervix with the anterior vaginal wall, the subpubic arch should normally be against the finger at or beyond the middle of the third phalanx (over two and one-half inches). The posterior fornix is unusually deep, and the posterior surface of the cervix may be felt to be convex in its long diameter. The angle of the anterior uterine wall formed just above the vaginal junction can usually be felt and sometimes the fundus itself. If necessary, a sound may be passed to locate the uterine cavity and to differentiate between a tumor or an exudate that might be mistaken for the uterine body.

In anteversion the anterior vaginal wall is about three inches long as measured on the finger, but the os uteri is still farther back, and points toward the coccyx or sacrum. The cervix extends backward, and the corpus forward over the anterior vaginal wall, and is in a straight line with the cervix. The organ is usually larger and harder than normal.

**Treatment.**—The treatment of ante-flexion sufficient to cause symptoms should be a systematic dilatation of the cervix with graded conical sounds, or by rapid dilatation.

If the latter treatment is used, the dilatation should be maintained by means of the occasional passage of a large sound under the strictest antiseptic precautions. The endometritis may require treatment, or measures may be indicated such as are recommended elsewhere for treatment of puerile uterus.

In ante-flexion the following operation gives promise of recovery. The proced-

ure is comparatively easy. The result may be accomplished through a short incision by the following simple technique: The patient being in the Trendelenburg position, the bowels are pressed out of the way with gauze and are held back with a broad retractor, which is carried to the bottom of Douglas's pouch. Finding the point of insertion of the ligaments on the posterior uterine wall, this point is seized with a pair of bullet-forceps. Traction is now made and the ligaments are put on the stretch, the body of the uterus being held forward, out of the way, by the forceps. Each ligament is now raised in turn with a blunt hook, and is freely divided near its uterine attachment. Any remaining fibres are felt with the finger and divided in the same manner.

For protection against hæmorrhage and to avoid denuded tissue in the pelvis, the edges of the peritoneum are brought together by a few catgut sutures. The uterus is now lightly suspended by two chromicized-catgut sutures through the fundus, or just anterior to the fundus, according to the degree of the flexion. This keeps the divided ligaments apart until they have healed, and so guards against a relapse. Dysmenorrhœa and backache are usually relieved in large measure, if not wholly abolished; bladder irritability—aside from actual cystitis—yields at once; sterility is overcome in a fair percentage of cases, and the progressive endometritis and parametritis are cut short in a much larger number. As for the cases in which pregnancy supervenes, nausea and vomiting, if they occur at all, are certain to be much less severe than would have been the case had the tight ligaments remained to tie back the cervix in the hollow of the sacrum, and they yield readily to local treatment. R. A. Kingman (*Annals of Gynec. and Pæd.*, Jan., 1901).

### Retroflexion and Retroversion.

**Symptoms.**—These, like other uterine displacements, cause no symptoms unless connected with inflammation or its products, or unless they interfere with the

menstrual flow or with the uterine circulation. Many cases have no symptoms. When dysmenorrhœa is present, it often commences with cramping pains in the lower abdomen, as in ante flexion, but the pains do not usually cease as soon as the flow begins, and may continue throughout. Backache is a common symptom, and is apt to be increased during the period. The traction upon the base of the bladder occasionally causes persistent vesical irritability. Symptoms of pelvic inflammation are often present.

Three hundred women were examined from two to ten months after delivery, and the uterus was found retrodisplaced in 36, or 12 per cent. Eleven had no symptoms, while in the remaining 25 the symptoms were due to complications other than the displacement in all but 4. Ninety others under treatment for retroversion were carefully observed with the view of determining how far their symptoms were due to this condition alone, with the result that in 84 other complications existed (pregnancy, menorrhagia, prolapsus, disease of the adnexa and perimetrial tissues) which were the real causes of their sufferings. The conclusion is reached that the symptoms usually ascribed to retroflexion—dysmenorrhœa, menorrhagia, sterility, and tendency to abortion—are more often due to complications than to the displacement itself. Winter (Centralb. f. Gyn., No. 25, '97).

**Diagnosis.**—In retroversion the cervix is within two inches of the vaginal entrance and points toward the pubes, while the body can be felt to extend nearly straight backward into the hollow of the sacrum. In retroflexion the angle formed by the posterior walls of the cervix and corpus can be felt, and the body of the uterus is in or over the *cul-de-sac* of Douglas. In order to avoid mistaking the corpus uteri for a tumor or exudate, the absence of the former from its normal position can be readily demon-

strated bimanually. If necessary, a sound may be introduced.

**Treatment.**—If adhesions are present with exudate or diseased ovaries, these should be treated. Pelvic massage, forcible separation (Schultze), or peritoneal section may be required. Interference of the flexion with drainage may necessitate forcible dilation, and the endometritis may also call for appropriate treatment.

If, after the pathological conditions have been as far as possible corrected, the patient still suffers, the uterus should be replaced and kept in position by a pessary or by an operation. Replacement of the uterus may be accomplished as follows: With two fingers in the vagina push the cervix and posterior vaginal wall backward, and press the other hand from above into the pelvis just below the promontory of the sacrum, and push the fundus, which is raised by the backward pressure against the cervix, forward to the pubes. If this cannot be done, two fingers in the rectum may be made to push the fundus up out of the hollow of the sacrum so that the hand on the abdomen may pull it forward over the pubes. By attempting these manœuvres in the genu-pectoral position the weight of the uterus and abdominal organs may be made to assist. Küstner draws the cervix down toward the vulva with a vulsellum until the fundus is drawn out of the *cul-de-sac* of Douglas, and then turns the handle of the instrument up toward the pubes externally and pushes the cervix back toward the sacrum where the fundus had lain.

**Pessaries.**—After the uterus has been replaced it may be held in position for a few months by a pessary. The retroversion will usually recur when the pessary is removed, but the symptoms may not.

The Albert Smith or Emmet or



Thomas modifications of Hodge are the best forms. They are introduced with the short curve turning upward behind the uterus.

This instrument ought not to be entirely disregarded, and, now that the indications for its use are better understood and are on a more scientific basis, its former position is being partially regained. In uncomplicated cases in young women who have not had treatment operation should be advised. Operation also is the only method which holds out prospects of a cure in cases complicated with lacerations, enlarged uterus, or much prolapse. Otherwise, where the uterus is small, where symptoms have been present but a short time, and particularly if they are associated with neurasthenia, treatment by pessary will often result in a cure. In such selected cases cure may be expected in one-half. Even in cases where a cure cannot be hoped for by pessary its temporary use is often of value in relieving symptoms and in aiding to restore the general health. F. H. Davenport (Boston Med. and Surg. Jour., Aug. 7, 1902).

*Operations.*—When pessaries fail to relieve the symptoms, operations are indicated. If the uterus can be perfectly replaced and the fundus remains near the anterior vaginal wall after being released, and the parametrium feels soft, Alexander's operation or shortening the round ligaments through the inguinal canal may be depended upon to hold the organ in position. If there are adhesions to be separated or ovaries to be resected, or if the uterus immediately assumes its old position of retroversion after having been replaced, a vaginal or abdominal incision into the peritoneal cavity should be made and the round ligaments shortened through that opening. A suture of the uterus forward should, as a rule, be accompanied by a taking in of the slack of the round ligaments. The latter and slight peritoneal adhesions of the

fundus to the peritoneum over the bladder by means of catgut sutures is all that is ordinarily required.

The treatment of retrodeviations favors defundation in sterile women. In recent mobile deviations, the pessary may be employed with success. The period of genital involution is truly the psychological period for the pessary. Where the perineum is intact and there is no lesion of the adenexæ, the Alexander operation is the one of choice. Where there are adhesions to the adenexæ, laparotomy is indicated, followed by simple abdominal fixation and transfixation of the round ligaments. In the case of multiparæ where the perineum is torn, fixation should be associated with plastic operations upon the cervix, vagina, and perineum. In the case where retroversion is present and complicates pregnancy, medical, manual reduction of the deformity should be practiced. If this does not suffice to free the uterus from the pelvic cavity, celiotomy should be resorted to and the round ligaments should be shortened intra-abdominally. M. Morissette (*La Gynecologie*, June, 1903).

The anterior vaginal route is most useful to reach and operate upon the round ligaments in cases of retroversion of the uterus or procidentia; also for removal of small fibroids, either subperitoneal or pediculated, or for conservative work on the ovaries and tubes, or for removal of those organs. The posterior incision is most useful for drainage in cases of pyosalpinx, salpingitis, pelvic abscess, some cases of tubal pregnancy with hæmatocele and puerperal sepsis, either with or without involvement of the tubes; for oöphoro-salpingectomy, when the ovary is held backward and downward by old adhesions, and even in some cases of acute general septic peritonitis. Henry Mofat (*Medical Record*, Dec. 5, 1903).

Retroversion is essentially a pathologic condition, in that it is, either directly or indirectly, in the majority of cases, a source of discomfort or disease.

The intelligent use of the pessary will effect a cure in a large percentage of the

cases, but when used unintelligently the pessary is positively dangerous, as is the case with most surgical instruments and appliances.

Surgical treatment of retrodeviations is absolutely essential to a cure in a large proportion of the cases. The Alexander-Adams operation of shortening the round ligaments is right in principle, and will, more or less modified, maintain its position as a classic operation, for the cure of retrodisplacements.

No method of shortening the round ligaments within the abdomen will effect a cure in nearly all cases, because these methods fail to eliminate the weakest part of the ligament, the portion within the inguinal canal. The Gilliam modification of the Alexander-Adams operation is the operation of choice in these cases, because it is easy of execution and meets all the indications for the successful treatment of the displacement and of intra-abdominal complications which may be present.

Ventral suspension and ventral fixation are "unphysiologic" operations. They should not be performed in the case of patients susceptible of child-bearing. Vaginal operations for retrodeviations in fruitful women are mentioned only for condemnation. E. J. Mellish (American Medicine, Aug. 27, 1904).

### Prolapse and Procidentia.

**Symptoms.**—Backache, dragging sensations about the pelvic outlet, and difficulty in urinating and defecating are common symptoms. In procidentia, ulceration of the protruding vagina or cervix, cystitis, and urethritis may be troublesome. Leucorrhœa and other symptoms of metritis, as well as those of neurasthenia, debility, indigestion, etc., complicate many cases.

**Diagnosis.**—In prolapse the cervix will be found near or at the vaginal entrance, with or without a protrusion of the anterior or posterior vaginal wall or both (anterior and posterior colpocele), carrying, perhaps, the bladder (cystocele) or

rectum (rectocele) with it. A recto-abdominal, bimanual examination reveals the fundus either in the *cul-de-sac* of Douglas or low down behind the pubes.

In protrusion the cervix uteri can be seen, and will admit the uterine sound. Rectal palpation reveals the absence of the uterus from the pelvis, and perhaps the projection of the anterior rectal wall into the vulvar tumor. A catheter introduced through the urethra will show whether the bladder is up behind the pubes or external to the vulva. In complete procidentia its posterior wall nearly always follows the cervix out of the pelvis.

The parts can be pushed back into the pelvis and be palpated in their normal relationship.

In case the cervix only is prolapsed and elongated the uterine sound will usually penetrate four or more inches. The rectal examinations inform us that the fundus is only moderately prolapsed, while the cervix is long and thin. When the elongation is just above the level of the anterior vaginal junction, the anterior vaginal wall comes down with the cervix and the posterior vaginal fornix retains more or less of its depth. When the elongation is in the upper part of the cervix above the posterior vaginal junction, the posterior fornix descends. When both of the fornices remain deep it is mainly the vaginal portion of the cervix that is elongated, usually hypertrophied.

**Treatment.**—Operative treatment is, as a rule, necessary for the cure of protrusion. However, in many cases of prolapse and protrusion without distressing symptoms the patient may prefer palliative measures. Pelvic massage will often produce a partial cure (Thure Brandt's technique).

The patient can ordinarily push the



parts back and retain them during the day-time by introducing large cotton or wool tampons, or a rubber inflatable bag, and inflating it. A soft-rubber elastic ring-pessary can sometimes be introduced by the patient every morning and removed every night. Soft-rubber pessaries should never be worn continuously. A hard-rubber or large Albert Smith pessary can be worn continuously with great comfort in some cases. The prolapse returns when the pessary is removed.

*Operations.*—When the prolapse is the result of lacerations during childbirth it is usually necessary to curette the enlarged subinvolved uterus, repair the laceration or amputate the enlarged cervix, perform anterior and posterior colpotomy and perineorrhaphy, as well as remove any hæmorrhoids or protruding anal folds. If the fundus uteri sinks into the hollow of the sacrum as the cervix is pushed within the pelvis, it is best to perform Alexander's operation and thus turn the fundus forward behind the pubes. When the fundus is allowed to remain in the posterior *cul-de-sac*, the cervix points forward and acts as a wedge to force the vulva open. In case the patient is at the change of life, vaginal fixation, or uniting the anterior wall of the uterus to the anterior vaginal wall, may be employed to accomplish the same purpose.

In extreme cases the uterus has been removed by abdominal hysterectomy and the stumps attached to the abdominal wall. Vaginal hysterectomy supplemented by a narrowing of the vagina and perineorrhaphy has also proved successful.

Panhysterocolpectomy—a new prolapsus operation—consists in complete removal of the uterus and vagina, followed by operative obliteration or columnization of the bed of the genital

tract. The tubes and ovaries are not disturbed, if healthy; if diseased, they are removed with the uterus and vagina. Obliteration and columnization of the bed of the removed uterus and vagina are effected by means of from seven to nine buried pursing sutures of chromicized catgut placed about two to two and a half centimetres apart, and running parallel to each other. Each suture gathers the raw surfaces from the periphery in circular fashion, and draws or purses them together in the median line. It is buried by being pushed upward toward the abdomen, while the next suture is being tied beneath it. G. M. Edebohls (Medical News, June 22, 1901).

Notes of 130 cases of procidentia uteri treated by operation. In this condition curettage is usually of but little importance. Amputation of the cervix promotes involution of the uterus when this organ is much hypertrophied. Resection of the anterior vaginal wall serves to remove the redundancy of overstretched tissue, and thereby prevents further descent of the uterus. The restoration of the supporting function of the perineum or sacral segment of the pelvic floor is secured by means of modified Emmet perineorrhaphy. Suspension of the uterus restores that organ to its position of ante flexion. Charles P. Noble (American Medicine, Jan. 11, 1902).

**Inversion of the Uterus.**—Inversion signifies a turning of the corpus uteri into the cervix (partial) or through it (complete). The uterus turns inside out. It only occurs when the uterus is (1) enlarged and (2) partly or completely relaxed. These conditions are found in the puerperal state and during the presence of polypoid or submucous uterine tumors (usually myomas).

The CAUSES in the puerperal state are pressure upon the fundus uteri or traction upon the umbilical cord, or both, during the third stage of labor. Adherent placenta and a short umbilical cord are favorable to its occurrence. After a

partial inversion has taken place, abdominal pressure may complete it, or the projecting fundus or tumor may be caught in the cervix and be expelled into the vagina by the contractions above it.

**Symptoms and Diagnosis.**—Sudden complete inversion occurring during labor is often accompanied by fatal hæmorrhage unless immediate reduction is effected. If the patient escapes death by hæmorrhage, septicæmia is apt to follow later.

More often the onset is gradual and hæmorrhage is more or less continuous and abundant. Leucorrhœa and metrorrhagia, with the symptoms of metritis, anæmia, and nervous exhaustion; constitute the chief subjective evidences of the disease.

An inverted uterus may be differentiated from a fibroid polypus by the following signs:—

The inverted uterus in recent cases is darker, softer, and more sensitive, and the cervix is represented by a shallow depression all the way around. A fibroid can be twisted slightly without carrying the cervical rim with it. The cervical rim can, in some cases, be made to disappear by means of traction exerted upon the fundus, completely inverting the entire organ. The orifices of the Fallopian can sometimes be detected and the relations of the parts be thus determined.

Bimanual recto-abdominal examination demonstrates the absence of the fundus from the pelvis, the presence of a cup-shaped depression, and in old cases the presence of the ovaries at the edges of the depression.

When the uterus is completely inverted by a polypus, the deviation of the polypus from the size, symmetry, and evenness of surface of the uterine body, and a depression at the level of the attachment may aid us in discovering the

character of the tissues. A shallow incision, which can be quickly sutured, will reveal the structure of the tumor and the existence of a capsule.

**Anatomy and Pathology.**—The fundus may be (1) merely indented, or (2) the entire corpus may project through the cervix, or (3) the cervix and corpus may be completely inverted, like a bag turned inside out. The first and third conditions exist, as a rule, only temporarily and while traction upon the corpus is being made; hence the second one constitutes the type.

Before involution has taken place the peritoneal cup within the cervix is large and contains the Fallopian tubes and ovaries. Right after labor the fundus projects into the vagina as a large, soft, purplish, spongy mass. This gradually becomes smaller and harder and smoother as involution progresses. The discharge, at first bloody, soon becomes a bloody mucus, and the membrane assumes the characteristics of hyperplasia.

After involution the body becomes hard and pear-shaped, and the ovaries and tubes are no longer contained in the peritoneal cup. The mucous membranes undergo atrophy, although in places glandular pockets dip into the mucous membrane. Gangrene of the fundus is a possible, although extremely rare, occurrence.

**Prognosis.**—Hæmorrhage, local discomfort, leucorrhœa, etc., may lead to profound anæmia and depression, and finally to exhaustion. In the puerperal state immediate death from hæmorrhage or inflammation, or perhaps death later from sepsis, may take place.

**Treatment.**—Immediately after labor the knuckles should be pushed steadily against the projecting mass until it recedes through the relaxed cervix. Then (but not until then) measures should be



used to contract the uterus, such as ergot hypodermically, judicious massage over the fundus, or—if necessary—a hot intra-uterine douche or antiseptic gauze packing.

In recent cases beyond the puerperium taxis may suffice. Prolonged traction upon the cervix with a vulsellum combined with attempts to enlarge the cervical ring by eccentric pressure, and compression of the corpus uteri with the hands or padded forceps may be followed by an attempt to indent one of the horns by the fingers formed into a cone, while the traction is being kept up.

Counter-pressure by means of the index fingers introduced into the bladder and rectum, respectively, while the thumbs in the vagina press against the fundus, has proved successful in two or three cases.

In older cases the *gradual method* is the best. The fundus is pushed back toward the sacrum, and a rubber bag is introduced between it and the coccyx and sacrum, and inflated. Elastic continuous pressure is thus made toward the pelvic brim and the resistance of the uterine tissue is gradually overcome. The vagina is thoroughly douched before each introduction of the bag, which is taken out and cleaned every forty-eight hours. Two or three days or as many weeks may be required for the reduction.

When all other methods fail, an operation will usually succeed. The posterior uterine wall may be incised longitudinally in the median line, and the cervix stretched by means of dilators introduced into the peritoneal cup through the incision. If the constriction ring dilates sufficiently, the incision is sutured and the fundus pushed up through the dilated parts (B. Bernard Brown).

In case the cervix does not yield to the dilators, the incision can be length-

ened until it extends from the fundus through the cervix into the posterior vaginal wall. At its extremity a transverse incision is made across the posterior vaginal fornix into the *cul-de-sac* of Douglas, and the uterus is easily turned right side out and sutured in the vagina. Then the fundus is pushed through the posterior vaginal opening and up into its proper position (Küstner).

On account of the liability to the occurrence of retroversion with adhesions after the posterior incision, it is preferable to similarly incise the anterior uterine and vaginal walls, separate the bladder, open the peritoneal cavity, restore the uterus to its normal shape, suture the uterine incision, and attach the fundus over the bladder, and—if necessary—shorten the round ligaments intra-peritoneally, before finally closing the vaginal incision.

T. G. Thomas recommended 'opening the abdomen and dilating the cervix from the peritoneal side. When this fails Everke incises the posterior cervical wall, and—if necessary—the anterior, reduces the displacement, and then sutures the uterine wound.

A simple operation for prolapsus consists in making a transverse incision through the vaginal mucous membrane in front of the cervix, dissecting off flaps, and closing the wound vertically. If necessary, the cervix may be drawn backward by making a vertical incision in the posterior fornix and uniting the flaps transversely. Schücking (Brit. Gynæc. Jour., No. 2, 1900).

**Tuberculosis of the Uterus.**—CORPUS.—Tuberculosis of the uterus may be caused, primarily, by tuberculous semen, instrumental inoculation, etc., but is nearly always secondary to tuberculosis in other parts. Although in the corpus it may exist in any stage, the miliary form is not recognizable clinically, and hence the ulcerative stage is the one

usually encountered. The disease commences as small miliary tubercles, usually near the fundus, and spreads diffusely throughout the mucous membrane. In a few instances it develops in the uterine wall, constituting the interstitial form.

*Symptoms and Diagnosis.*—The early symptoms are those of endometritis, sometimes with menorrhagia. Later the uterine walls are thickened, and there is a grumous discharge containing cheesy particles. The menses are then apt to be scanty.

The diagnosis may be based upon a microscopical examination of uterine scrapings or inoculation of a guinea-pig. The presence of tubercles in other organs, the absence of foul-smelling watery discharges, and the slow progress distinguish it from cancer or sarcoma of the endometrium.

*Treatment.*—The uterus and appendages should be extirpated *per vaginam* unless the condition is secondary to advanced tuberculosis elsewhere. If the appendages are palpably affected, or if there be encysted tubercular peritonitis, the abdominal method is preferable.

In case an hysterectomy is contra-indicated, a curettage and package of the uterine cavity with iodoform might retard the progress of the disease.

**CERVIX.**—Tuberculosis of the cervix consists of a round-cell infiltration of the subepithelial structures, containing tubercular nodules. The glands over the affected portions show epithelial proliferation and sometimes form papillary masses. The vaginal portion is somewhat enlarged, nodular, and partly covered by a circular granular wound that gives off a sticky, grumous discharge.

The *symptoms* are at first those of cervical endometritis. Later the grumous discharge, containing glandular matter,

the local pain, and the microscopical evidences obtained from a piece of excised tissue serve to establish a diagnosis.

The *prognosis* is usually bad because of the existence of the disease elsewhere in the system. If discovered early, the area of localization can be extirpated and the infection eradicated.

*Treatment.*—In the early stages a high amputation of the cervix may be depended upon unless uterine scrapings show signs of tuberculosis or decided inflammatory changes in the endometrium. If the vaginal fornices are affected, the vaginal wall should be excised well beyond the disease and the wound be strewn with iodoform powder and sutured.

#### Tumors of the Uterus.

**Myoma of the Uterus.**—Uterine myoma consists of one or more masses of fibromyomatous tissue developed in or upon the uterine walls. According to their location they are called polypoid, submucous, intramural, subserous, pediculated, and intraligamentous.

The polypoid tumor develops near or just under the mucous membrane, and, as it grows larger, projects into the uterine cavity. It remains attached by the mucous membrane and a few connective-tissue fibres, which form a pedicle of greater or less size and density, according to the amount of fibrous tissue dragged with it from the uterine wall. The submucous starts a short distance from the mucous membrane and projects more or less upon the surface. The uterine cavity in these two varieties enlarges as the tumor grows. The intramural develops well within the uterine wall and retains a thick covering of uterine fibres. The uterine cavity enlarges in proportion to the relation of the tumor to the mucosa. The subperitoneal variety is developed near the peritoneal covering, and causes a projection upon the



serous surface without increasing to a great extent the size of the uterine cavity. The pediculated tumor develops just under the peritoneum and projects from the surface. The intraligamentous tumor projects into the connective tissue of the broad or sacro-uterine ligaments. From 5 to 10 per cent. develop in the cervix. Myomas may be single or multiple, each with a capsule, or several masses may be developed in one capsule.

**Symptoms.**—In the polypoid, submucous, and interstitial varieties menorrhagia and metrorrhagia are the most prominent symptoms, with or without mucous or watery uterine discharges between. The menopause may be delayed beyond the fiftieth year. Such tumors may be accompanied by painful uterine contractions either from pressure of the polypus upon the cervix (acting like a foreign body in the uterus) or from obstruction of the cervix by the projection of a tumor growing near the cervix. The interstitial and submucous varieties may cause ovarian hyperplasia with its symptoms; or painful pressure upon the rectum, bladder, or pelvic nerves; or even obstruction of one or both ureters.

Sterility, early abortion, and dystocia are apt to be present. Anæmia is a common result of the loss of blood.

Report of 35 cases of fibromyoma of the uterus. But 13 of these patients had borne children. They were found in 3 unmarried sisters, over thirty years of age, whose histories were given. As fibromyomata degenerate early, their removal is indicated as soon as a diagnosis is made. Enucleation may be performed, but in 34 cases total hysterectomy was performed, 6 times *per vaginam*, with successful recovery in all. Of the 28 abdominal hysterectomies, but 1 patient died — of hæmorrhage. Debersaques (Jour. de Chir., Dec., 1901, Jan., 1902).

Examination of 18 myomatous uteri showed that the endometrium in cases attended with hæmorrhage does not dif-

fer in any characteristic way from that of cases which do not bleed; on the other hand, in the muscular tissue of the former the muscular areas are smaller, the connective tissue surrounding them thicker, and the blood-vessels more numerous and of larger calibre, than in the latter. There is, in fact, the condition known as myofibrosis uteri. Theilhaber and Hollinger (Archiv. f. Gynäk., Bd. lxxi, S. 289, 1904).

The subperitoneal and intraligamentous growths have but few symptoms until large enough to press upon the surrounding organs, when they cause pelvic pain, vesical and rectal distress, constipation, and, in rare instances, serious impaction of fæces in the colon.

**Diagnosis.**—*Single intramural, submucous, and polypoid* myomata enlarge the uterus symmetrically, and must be differentiated from pregnancy, hæmatometra, flexions, carcinoma, sarcoma, and subinvolution. The introduction of the sound when pregnancy is excluded, and, in case of large tumors, the introduction of the finger, reveals the increased size of the cavity and perhaps the presence of a polypoid or sessile growth. In case of flexion the sound passes directly into the supposed tumor instead of over or behind it. The symptoms of the above-mentioned conditions should be looked for.

*Intramural multiple* myomas produce a characteristic irregular enlargement and hardening of the uterus, with long, irregular cavity that is difficult to sound. Adherent ovarian tumor or inflamed appendages simulate fibroid enlargement, but are connected with a history of inflammation, with a congested or hyperplastic cervix, tenderness, and a sulcus between the uterus and the projecting mass. The uterine cavity may be but slightly enlarged. A myoma of the vaginal portion gives the os a crescentic shape, with flattening of the opposite lip. Carcinoma does not thus alter the shape

of the os, is harder, and, if ulcerated, is excavated and fissured, instead of being merely eroded. The tenaculum holds firmly in the fibroid, while it tears out of cancerous tissue easily and causes free bleeding.

Very large soft myomas or cystomyomas of the corpus cannot always be satisfactorily diagnosed. The myoma usually draws up and immobilizes the cervix, and the uterine cavity admits the sound farther than normal. The uterine body can be palpated, and vascular murmurs can be heard over the sides of the tumor. Slow growth is characteristic of uterine myomas and ovarian dermoids.

**Etiology.**—They are supposed to develop from the walls of the blood-vessels. Vascularity in connection with micro-parasitic development would seem to be in line with the tendency of recent discoveries in bacteriology.

**Pathology.**—The young tumor is composed of fibrous and muscular tissue irregularly interlaced, which develops in different proportions in different growths. It presents a whitish or yellowish-white, glistening surface, unless an unusual amount of muscular tissue is present, when it will be pinkish. The submucous and polypoid tumors retain some of the glandular structure of the mucosa, while a variety called adenomyoma is partly composed of glandular structure, and when cut presents the appearance of a coarse net-work of fibres, instead of the ordinary smooth sheen.

As they develop they usually deviate somewhat from the type. Those which are surrounded by anæmic tissue, as the multiple and subserous, grow slowly and become hard and fibrous and sometimes calcareous. Those which are surrounded by vascular tissue, as in the single intramural and submucous, grow comparatively fast, but, being poorly supplied

with blood-vessels in their interior substance, are apt to undergo œdematous, myxomatous, cystic, and fatty changes. Sarcomatous and carcinomatous transformation may also take place. The hard tumors seldom grow very large, the soft ones often do, while the cystic may even destroy life by their great size.

All cases of so-called carcinomatous degeneration of fibromyomata uteri are, in reality, simply secondary carcinomatous infiltration of the tumor from primarily diseased endometrium. Rode-macher (*Centralb. f. Gyn.*, No. 41, '97).

In studying the vascular supply of the uterine muscle by means of injections, small bloodless foci (*ilots*) were found, which seemed to increase in size at the expense of the surrounding muscular fibres. Around the minute myomata were zones of vascular tissue, which evidently served to nourish them. In the centre of the nodule could often be seen what appeared to be the lumen of a blood-vessel which had not been reached by the injecting fluid. These myomata grow first centripetally, then horizontally.

It is probable that uterine fibromyomata represent a localized hypertrophy of the tissue in the neighborhood of certain vessels, or the isolation of vascular areas due to thrombosis, prolonged pressure, or other circulatory disturbance. Keiffer (*Soc. Belge d'Anat. Path.*; *La Gynéc.*, Feb. 15, '99).

Seven cases of combined carcinoma and fibromyoma of the uterus. The capsule of the fibroid seems to oppose a certain barrier to the advance of the cancer. As soon as the capsule has been destroyed the malignant disease spreads rapidly through the fibro-muscular tissue. Only two cases have been recorded in which epithelial ingrowths developed in the centre of a fibroid, nor were they clearly demonstrated as evidence of actual malignant degeneration of the benign tumor. Hegar (*Centralb. f. Gynäk.*, No. 27, 1901).

**Prognosis.**—On account of their slow growth and a tendency to stop growing after the menopause, they may run a



comparatively benign course; yet in young people the persistence of the hæmorrhages and gradual growth may seriously impair the health before the advent of the delayed menopause.

**Treatment.**—The best treatment for growing myomas in women under thirty-five years of age is removal (enucleation) of the tumor, with preservation of the uterus, if possible, otherwise by hysterectomy with preservation of the cervix and ovaries. Removal of the ovaries for fibroids is now almost an obsolete practice, and has given way to myomectomy or myomotomy. In older patients persistent hæmorrhage, pressure pains, or rapid growth may call for radical treatment unless palliative measures prove rapidly beneficial. Slowly-growing tumors near the menopause without symptoms require only palliative treatment, and often none at all.

Polypoid or sessile intra-uterine growths smaller than a child's head at term can be removed through the dilated cervix, by morcellation. The uterus usually contracts readily after the removal, but, if not, a tight packing with gauze, which should be removed during the second twenty-four hours, and ergot internally, will prevent hæmorrhage.

Small subserous or intramural growths palpable on the anterior or posterior uterine walls can be enucleated and the bed sutured through an incision in the anterior or posterior vaginal fornix (anterior or posterior colpotomy). Such tumors, when larger than an egg, require abdominal section for their enucleation. Polypoid and submucous tumors larger than a foetal head at term can be enucleated by abdominal section and incision through the uterine wall. The uterus can then be sutured with catgut, and, if the bed cannot be obliterated by sutures, it can be packed with gauze that

extends out through the vagina, and the peritoneal side be closed. When many intramural myomas are present the uterus may be amputated at the internal os (supravaginal hysterectomy) or be removed with the cervix (total extirpation, panhysterectomy). Multiple small fibroids with symptoms may be treated by vaginal hysterectomy.

The health of a woman during her sexual period of life suffers less from the loss of her uterus than from the complete removal of the ovaries. Close observation and study of clinical reports show that continued menstruation after oöphorectomy occurs under two distinct conditions: (1) when oöphorectomy has been performed for inflammatory lesions of the tubes and ovaries; (2) when the operation has been carried out to anticipate the menopause in patients with uterine myomata. The operative disadvantages of abdominal enucleation of myomata compared with hysterectomy are many. A careful consideration of all the facts makes it clear that the uterus can only be considered as a receptacle or reservoir wherein oöspers may develop. It is secondary, and certainly subservient, to the ovaries. It is not a vital organ, and its removal entails two physiological sequelæ in women during the sexual period of life, namely: amenorrhœa and sterility. J. Bland Sutton (*Brit. Med. Jour.*, April 8, '99).

It is a very important matter to preserve ovaries to avoid the symptoms which removal brings, besides the moral suffering. In removing the uterus or a fibroid tumor an ovary should be left behind. Gynæcologists usually limit enucleation of fibroid tumors to solitary growths. Twenty-seven enucleations personally performed. The indications for enucleation should be so enlarged as to embrace cases in which several myomata are present. Olshausen (*German Surg. Cong.*; *Brit. Gynæc. Jour.*, Aug., 1900).

**Enucleation.**—This is accomplished by making an incision across the tumor, catching hold of it with a vulsellum or a hook passed between the separated edges of the incision, enucleating with

the fingers or blunt-edged instrument, and sewing up the bed with formaldehyde or formalin catgut.

*Abdominal supravaginal hysterectomy* is performed about as follows: Trendelenburg's position. Incision in median line extending from above pubes to below umbilicus. Separation of adhesions. Incision of capsule of any tumor that may be held down in pelvis, and enucleation of the tumor from its broad-ligament bed. Separation of the bladder from the

ture of anterior peritoneal flap over the stumps of broad ligaments and uterus.

An operation practiced at the Johns Hopkins Hospital, and demonstrated in upward of two hundred cases within the past two years, consists in the following steps:—

1. Opening the abdomen.
2. Ligation of the ovarian vessels near the pelvic brim, either on the right or on the left side, clamping them toward the uterus, and cutting between.
3. Ligating the round ligament of the same side near the uterus, cutting it

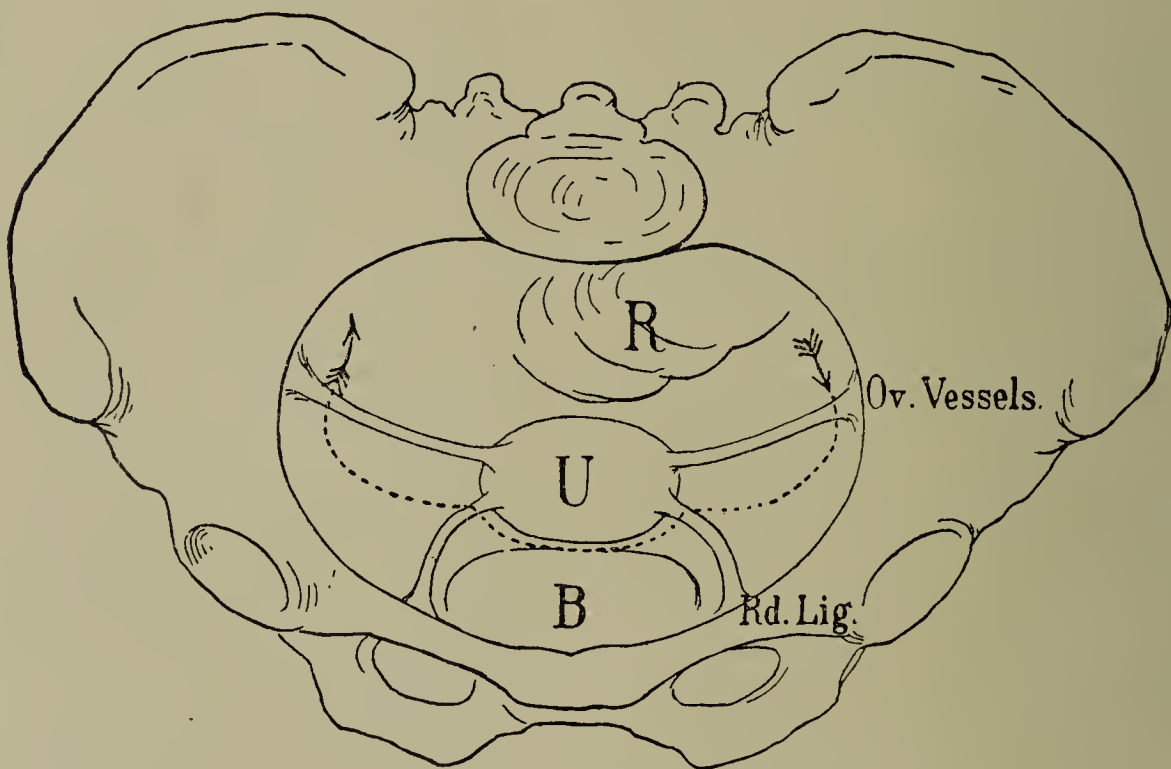


Fig. 1. (H. A. Kelly.)

uterus. Ligation of the ovarian and uterine arteries, or of the broad ligaments down to the internal os, clamping next to the uterus. Section of broad ligaments between ligatures. Amputation of cervix at the internal os. Disinfection of cervix. Excision of a transverse, wedge-shaped piece from cervix, leaving an anterior and posterior flap. Paring out the cervical mucous membrane. Suture of the two cervical flaps with superficial catgut sutures. Su-

free, and connecting the two incisions, in order to open up the top of the broad ligament.

4. Incision through the vesico-uterine peritoneum from the severed round ligament across to its fellow, freeing the bladder, which is now pushed down with a sponge, so as to expose the supravaginal cervix.

5. Pulling the body of the uterus to the opposite side to expose the uterine artery low down on the side opened up. The vaginal portion of the cervix is located with thumb and forefinger, and the uterine artery, seen or felt, is tied



just where it leaves the uterus. It is not always necessary to tie the veins.

6. The cervix is now cut completely across just above the vaginal vault, severing the body of the uterus from the cervical stump, which is left below to close the vault.

7. As the last fibres of the cervix are severed or pulled apart, while the body of the uterus is being drawn up and

9. Ligatures are now applied in place of the forceps holding the uterine artery, round ligament, and ovarian vessels; if the surgeon prefers, these may be tied, as they are exposed, without using forceps.

10. After the enucleation the operation is now finished in the usual way: (a) by closing the cervical tissue over the cervical canal, and then (b) by draw-

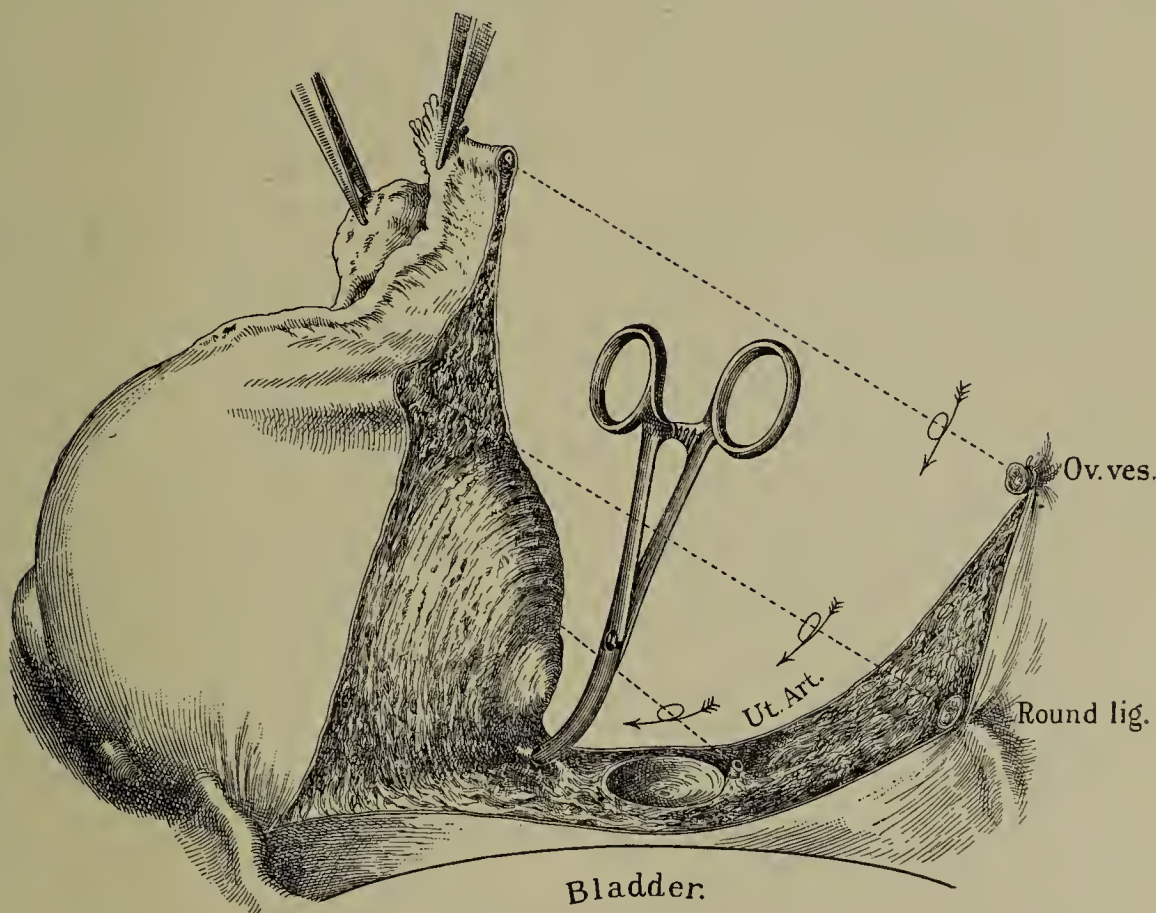


Fig. 2. (H. A. Kelly.)

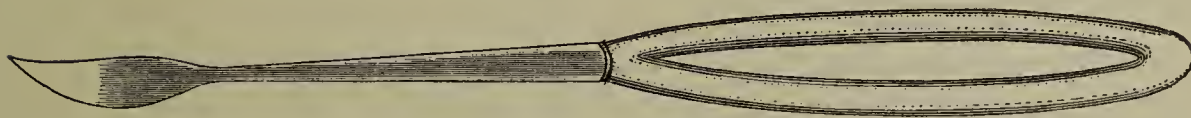


Fig. 3. (H. A. Kelly.)

rolled out in the opposite direction, the other uterine artery comes into view, and is caught with artery-forceps about an inch above the cervical stump.

8. Rolling the uterine body still farther out, the right round ligament is clamped, and cut off, and lastly the ovarian vessels are clamped at the pelvic brim, and the removal of the whole mass, consisting of uterus, tubes, and ovaries, is completed.

ing the peritoneum of the anterior part of the pelvis [vesical peritoneum and anterior layers of broad ligaments] over the entire wound area, and attaching it to the posterior peritoneum by a continuous catgut suture.

The continuous transverse incision should always be started on the side where the ovarian vessels and the ovary and tube are most accessible. If the case is one of a fibroid uterus, and the tumors

are developed under the pelvic peritoneum or in the broad ligament of one side, this side should be opened up last, from below upward, whereupon the tumors can be rolled up and out with surprising facility.

The abdominal incision is always closed without drainage, by using a continuous catgut suture for the peritoneum, interrupted silver-wire sutures for the fascia, a buried continuous catgut suture for the subcutaneous fat, and the subcuticular catgut suture for the skin. H. A. Kelly (Texas Med. News, May, '96).

Various operations that have been performed for fibromyoma of the uterus. At first these were restricted to fibrous polypi and, as hæmorrhage was feared, they were often strangulated by a ligature and allowed to become necrotic, thus giving rise to serious danger to the patient. Later enucleation was practiced, and, finally, when ovariectomy became a popular operation, they were removed through an abdominal incision. Porcelini suggested morcellement, the danger of which consists in the subsequent necrosis of the stump of the cervix. Hegar improved the treatment of the stump in this operation, and as far as life is concerned the results were fairly good. Intraperitoneal and extraperitoneal methods of treating the stump were then employed. Hegar then suggested castration in tumors of moderate size, and the results were very good. Another method is enucleation through the abdominal incision. This can only be employed in certain favorable cases. The latest operation is total extirpation through the abdomen. The operation is rapid; often the convalescence is protracted. Hegar (Münchener med. Woch., Nov. 25, 1902).

*Abdominal total hysterectomy* is performed in the same way as supravaginal hysterectomy until the uterus is amputated at the cervix. Then the entire anterior cervical wall may be divided in the median line, or the anterior vaginal wall may be grasped just in front of the cervix by forceps and the vaginal

canal opened between the forceps and the cervix. An incision is then carried laterally around the cervix guided by the finger passed through the opening made. The vaginal wall is caught by a forceps wherever vessels spurt. When the cervix is cut out catgut sutures and ligatures are put on the vaginal edges, and if possible all raw tissues drawn together. If this is impossible, the unapproximated surfaces should be packed with gauze that extends into the vagina, and the peritoneum be united over it.

Eight cases of abdominal hysterectomy for myoma performed according to Doyen's method. By this method the structures are rapidly divided between clamp-forceps, a posterior flap is cut downward into the posterior vaginal fornix, then the cervix is seized and drawn up and the tumor is gradually made to turn a somersault over the pubis. The three points in favor of the measures are: (1) The certainty of the procedure in spite of inflammatory complications, or the main tumor obscuring details; (2) the certainty of securing the uterine artery at a good distance from its origin, and (3) the ease with which the bladder and ureters are pushed out of the way of the field of operation. W. G. Spencer (Lancet, May 16, 1903).

*Vaginal hysterectomy* for fibroids is usually performed for tumors from the size of an egg to a foetal head at term. A curved incision is made in the vaginal wall around the anterior edge of the cervix, and extending from the sides of the cervix straight out laterally for half an inch on either side. The bladder is pushed away from the uterus, and the peritoneal cavity opened, if possible, by tearing. A corresponding posterior vaginal incision is made, and the peritoneal cavity opened just behind the cervix. The bases of both broad ligaments are ligatured with strong catgut, and the uterus cut loose from the broad ligaments



on either side as high as the ligatures are placed. The cervical canal is then incised laterally and the anterior wall of the cervix amputated. The anterior uterine wall is then grasped with tenaculum forceps, and a triangle is cut from its centre. Another is cut from either side extending higher up, and as tumors are encountered they are cut up and enucleated. Pretty soon the anterior uterine wall and tumors are all removed, and the posterior wall folds upon itself, allowing the fundus and uterine appendages to be pulled down into the vagina. The remainder of the broad ligaments are now ligated, and all uterine tissue cut away. The peritoneum is brought down with forceps and stitched to the vaginal walls before and behind, and then the anterior and posterior vaginal walls are brought together with sutures that catch and hold the stumps.

*Palliative treatment* is mainly used for the relief of hæmorrhage or pain and to check the growth of the tumors. Ergot is the most valuable palliative remedy. Occasionally it expels polypoid and sessile tumors through the cervix. By diminishing the vascularity of the uterine walls hæmorrhage may be diminished and sometimes the growth of the tumors arrested. Half a drachm may be given three times daily for half or two-thirds of the time, and be continued, if necessary, for a year or more, or off and on until the change of life. Fluid extract of hydrastis Canadensis ( $\frac{1}{2}$  drachm three times daily) has a slight influence of a similar character.

Electricity applied to the interior of the uterus may be made to cauterize the endometrium and thus temporarily relieve the hæmorrhage.

Curettage also acts beneficially upon the endometritis, and thus upon the hæmorrhage.

*Ligature of the vessels* supplying the uterus acts temporarily in diminishing the blood-supply to the uterus and in checking excessive hæmorrhage. The anastomotic circulation, however, restores, to a great extent, the original condition. The bases of the broad ligaments may be ligated through an incision in the lateral vaginal fornices (Martin, Dorsett, Gottschalk), or the upper portions may be ligated through an abdominal incision (Byron Robinson).

Remote results of and the indication for vaginal ligation of the uterine arteries in cases of myoma of the uterus:

1. Vaginal ligation of the uterine arteries in their different branches from the uterus to the point of division is an operation entirely devoid of danger. It is preferable to ligate in three or four stages, after the freeing of the bladder, the cervix, and the broad ligaments on each side, the ligamentum cardinale, and the base of the broad ligament, with strong silk in a Deschamps needle. This operation was well supported even by women entirely exsanguine and exhausted, who would assuredly succumb to radical intervention.
2. After this operation the uterus and its tumor can receive no more arterial blood save by the internal spermatic artery and by means of the artery of the round ligament from the terminal ramifications of the epigastric artery.
3. The nutrition of the uterus is assured after the operation.
4. The vaginal ligation of the uterine arteries, in suitable cases, can subdue better than any other palliative method the hæmorrhages of myomata, and reduce the tumors to nuclei so small that they are no longer evident in clinical examination.
5. But it is essential to choose cases suitable to the method.
6. The following data are submitted: (a) The myomata most amenable to the method were essentially interstitial myomata developed in the inferior and middle portions of the womb, rather than those situated at the fundus. Intraligamentary tumors were altogether inadmissible. (b) The nearer the subject to the menopause, the greater

the chances of a radical success by the method of ligature. (c) The method was especially applicable in those cases in which the tumor did not exceed in size a woman's head. (d) If pelvic peritonitis had preceded, it was very likely that the tumors had contracted adhesions with neighboring organs, particularly with the epiploön, and that they drew therefrom new arterial vessels which would render success doubtful. (e) Before the scraping of the uterine mucosa, which is always the first step in the operation, the uterus should be dilated with a tent in all cases in which there is reason to suspect a myoma beneath the mucosa, since it is better to extirpate radically the myomas situated in the uterine cavity. S. Gottschalk (N. Y. Med. Jour., Aug. 25, 1900).

### Carcinoma of the Uterus.

**Cervix Uteri.**—Carcinoma affects the cervix uteri more often than any other part of the body. It may occur at any age after puberty, but most frequently develops between the thirty-fifth and sixtieth years.

Three varieties are met with, viz.: the pavement-cell carcinoma and the ulcerating and infiltrating (nodular) forms of the cylindrical-cell carcinoma. The pavement-cell variety starts, as a rule, on the vaginal portion, and the cylindrical-cell within the cervical cavity; but when, from laceration, erosion, or other cause, the endocervical epithelium becomes squamous, or that of the vaginal portion becomes cylindrical in character, the place of origin may correspondingly change.

**SQUAMOUS-CELL CARCINOMA** commences as a papillary growth covered by thickened layers of epithelium. The changes are largely confined to the surface, gradually projecting, rather than extending deep into the tissues, until they reach the vaginal wall, by which time they invade the deeper structures. It does not extend to the cylindrical epi-

thelium of the cervix until late. The overproduction of epithelial cells is surrounded by an overgrowth of connective tissue, producing fingers, or cylindrical-shaped masses, of cells that seem to project into the deeper tissues, but, in reality, extend only a short distance below their original level. The surface soon becomes fissured and necrotic, and is covered by a grumous, sticky, offensive discharge containing cell *débris*.

**CYLINDRICAL-CELL carcinoma** starts as a small nodule in the mucous membrane that may spread superficially, producing extensive ulceration. It extends quite early into the uterus, but does not cross to the pavement-epithelium of the vaginal portion until late.

In other cases the cervical walls are infiltrated before the ulceration becomes extensive, and the cervix is enlarged and hardened, and exhibits the ordinary histological characteristics of carcinoma. Later the process of necrosis excavates the cervix until nothing but a shell is left.

In all forms ulceration follows sooner or later; the extension and excavation may in time reach the bladder, rectum, or ureters, and finally open these organs, and may convert the pelvic interior into a large ulcerating cavity. Obstruction of the ureters is sometimes caused by the infiltration.

**Symptoms and Diagnosis.**—Occasional slight hæmorrhages, becoming more frequent and later more abundant and offensive, constitute one of the first symptoms. A gray watery discharge, resembling dish-water and becoming more and more foul-smelling from the admixture of necrotic tissue, is observed between-times. Pain is usually a late symptom, and is a result of extension to the surrounding tissues. A severe pain extending into the iliac region or hip is more



often the earliest pain. Later pains due to the surrounding cystitis, rectitis, or peritonitis may become prominent.

Anæmia, general debility, faulty digestion, septicæmia, and uræmia develop as the result of the local inflammation and sepsis.

Squamous-cell carcinomas give to the examining finger the notion of an induration or tumor of the cervix; in early cases a mere projection of one lip, later a large mushroom-shaped growth. The surface, at first smooth and hard, soon becomes fissured and friable, and bleeds freely whenever firm pressure is made upon it. The os is seldom in the centre, as is the case when a similar mushroom shape is produced by laceration and eversion, for the changes commence on one part of the circumference, and affect that part first and to the greatest degree.

The surface, before ulceration, has a purplish color, with grayish patches corresponding to the accumulations of epithelial cells. The ulcerated surface is irregularly fissured, and has a vascular border. It presents a mottled appearance, produced by yellowish-gray necrotic areas surrounded by vascular spots in which small blood-vessels may be seen. A cheesy substance can be pressed out. All manipulations produce a persistent, bloody oozing. If the odor is not perceptible upon introducing the speculum, it will be detected when the discharges are seen, or by smelling of the examining finger.

Cylindrical-cell carcinoma without infiltration does not alter the shape or appearance of the cervix until far advanced, unless there is eversion. An introduction of the sound or dilator will usually bring out a thin, foul-smelling discharge or some granular matter and blood. If there is eversion an irregular-fissured, excavated, yellowish-red ulcer, with abrupt

vascular edges, will be seen. The surface is hard, but bleeds easily.

When the cervix is infiltrated the cervix feels hard and inelastic and globularly enlarged, the largest portion being above the vaginal junction. The vaginal portion may be normal in color, but a tenaculum hooked into it will tear out easily and cause free bleeding, while in a hyperplastic cervix, or one enlarged by a myoma, the tenaculum will hold firmly. Just before ulceration the cervix may present a yellowish-pink, granulated, glistening surface that in connection with the above is quite characteristic. The tenaculum readily tears out of a cervix that has undergone cystic degeneration, but the laceration-tissue does not bleed profusely, like carcinoma.

If the surrounding parts are infiltrated, glands will be felt beside or behind the cervix, or indurated tissue extending from the cervix under the broad or sacro-uterine ligaments, often reaching to the walls of the pelvis and immobilizing the uterus. When the ulceration reaches the vaginal junction, the parametrium is always infected.

The earliest symptoms differ, depending upon whether the disease begins during menstrual life or after the menopause. During menstrual life every bleeding is compared with what it has been in the same woman, and arouses suspicions when intermenstrual spotting and serous discharge occur. After the menopause any serous or sanguineous discharge is considered significant. Every woman over thirty who may exhibit any menstrual vagary or persistent leucorrhœa is examined. Polak (New York Med. Jour., July 19, 1902).

**Prognosis.**—The only hope of a cure is to remove the cervix or uterus very soon after the commencement of the disease. When the vaginal walls or parametric glands become affected, a cure can no longer be expected.

**Treatment.**—The best treatment is an early high amputation or hysterectomy. At present hysterectomy enjoys the greatest popularity, although, if cancer of the vaginal portion could more often be discovered earlier, amputation would probably find a place in the treatment. When amputation is resorted to, it should include quite a wide collar of vaginal mucous membrane, and should be made an inch higher than the diseased area. Were it not for the greater danger involved, abdominal hysterectomy would be preferable to vaginal, because the pelvic glands could be enucleated in this way; but there is no hope of a permanent cure resulting when the glands have become affected.

*Vaginal hysterectomy* is performed somewhat differently for carcinoma than for myoma or inflammation, the difference being that we must remove as much of the surrounding tissue as possible for the former. The diseased tissue is curetted away and the cervix and uterine cavity mildly cauterized. An incision is made around the cervix in the vaginal wall fully half an inch from the diseased area. After separating the bladder, pushing it high up, and opening into the peritoneal cavity both before and behind, heavy silk ligatures are placed upon the bases of the broad ligaments about half an inch from the cervix, and tied as tightly as possible, in order that the tissue may afterward slough off. The bases of the ligaments are then cut through, and the upper portions tied. The uterus is then cut loose, the peritoneum joined with catgut to the anterior and posterior vaginal walls, the stumps united in the median line, and the corners or sides of the vaginal wound closed at the sides. The ligatures are left long, and hang out through the ununited centre of the vaginal wound. Sterilized iodoform gauze

is packed into the wound and against the stumps and in the vagina, and left for four or five days, when it is removed and an unirritating antiseptic douche used. The patient is kept in bed two weeks, given only water the first twenty-four hours, liquid diet during the second and third days, and very simple, mostly liquid, diet for the remainder of the first week. The ligatures will come off in two weeks if they have been tied tightly, and will bring a slough with them.

*Vaginal hysterectomy with forceps* differs from that with ligatures in the fact that long-handled hæmostatic forceps are applied to the broad ligaments instead of ligatures, and are left for thirty-six or forty-eight hours, when they are removed. A pair is placed upon the base of each broad ligament, including the sacro-uterine ligament, and after the cervix is cut loose another pair is put on the remainder of each ligament. The connective-tissue vessels are secured by lighter forceps. A gauze packing is then placed between the forceps and left for two days after the forceps are taken off. The patient suffers great discomfort until they are removed.

Statistics of total hysterectomy for cancer of the cervix give the following results:—

Operators.	Number of Operations.	Recovered.	Died.	Percentage of Mortality.	Percentage of Complete Cures after 2 Years.	Percentage of Recurrences before 2 Years.
Fritsch .....	72	64	8	10.1	35.0	57.7
Leopold .....	73	69	4	5.4	52.0	30.4
Schauta .....	65	60	5	7.6	47.3	52.7
Olshausen....	40	...	...	...	45.5	54.5
Ott .....	17	17	...	...	11.7	58.8
Fenomenoff .	18	18	...	...	50.0	16.6

Excluding the percentages of recurrence in Fenomenoff's cases, and the cases of absence of recurrence in Ott's, the time of observation being, it would



appear, too short in both instances, the totals will be:—

Complete cure....47.0 per cent.  
Mortality ..... 4.5 per cent.  
Recurrence .....50.8 per cent.

Comparing amputation of the cervix with total hysterectomy, it is found that in the latter the percentage of recoveries is higher, but so is the percentage of recurrences. Partial resection of the cervix by the curette or the cautery is a better palliative than any more radical step when the parametrium is infected. Smirnoff (*La Gynéc.*, Feb., '96).

Series of collected cases from the large clinics in Europe showing that, among 31,482 patients suffering from cancer, the seat of the growth was the uterus in 29.5 per cent. In all cases of cancerous uterus the entire organ should be removed. Personal experience in 176 cases has shown that, although epithelioma tends to be limited to the vaginal portion and that glandular carcinoma shows a remarkable tendency to limitation at the internal os uteri, there are many exceptions. The tubes in all cases of cancer of the uterine body should also be removed. Again, cervical cancer in many instances extends down the vagina in an invisible form under the mucosa, without at first causing any perceptible infiltration or blush of color to excite suspicion. It is most necessary, therefore, to give the disease a wide berth in the vaginal side, cutting at least 2 to 2.5 centimetres away from it. If there be the slightest involvement of the bladder-wall, that organ must be opened and the healthy flaps brought together after excising the disease. If the rectal wall is much involved, the cellular tissue laterally is also affected.

Results of operation: In 103 personal cases in which microscopical examination was very carefully carried out the results were as follow: Well without relapse on January 1, 1900: 1. Squamous-celled carcinoma of the cervix: 61 cases, 13, in all, living, or 21 per cent. 2. Adenocarcinoma of the cervix: 12 cases, 2, in all, living, or 16 per cent. 3. Adenocarcinoma of the body: 30 cases, 19, in all, living, or 63 per cent. The periods elapsed varied from six years to eleven months.

The old plan of skinning or shelling out the bare uterus is, of all methods, the most liable to be followed by a recurrence, and must be abandoned. It is of supreme importance to catheterize the ureters to mark them out and so use them as guide.

Operation of quadrisection of the uterus personally used in 11 cases for the more complete removal of the disease. Thorough curettage with a serrated spoon curette; division of the vagina on all sides an inch below the diseased area; separation of the vagina from the bladder up to the vesico-uterine peritoneal fold, which is widely opened; a wide opening of the posterior *cul-de-sac*. The uterus, now hinged by its broad ligaments, is brought out through the anterior opening, as in Martin's operation on the adnexa. This is easily done by pushing back the cervix and climbing up the anterior face of the uterus, step by step, until the fundus is reached, with stout-toothed forceps. The peritoneum posteriorly is well protected by an abundant loose gauze pack. The next step is the sagittal bisection of the uterus from the fundus through the cervix and the attached vagina with scalpel and scissors. As the uterus is cut in halves in this way each median surface is grasped and held down by strong-toothed forceps. One-half, the most affected, is now allowed to retract into the vagina, while half the body of the uterus of the other side is removed by bisecting it horizontally at the cervical junction, cutting from the median cut surface out into the broad ligament and exposing in this way the uterine artery, which is clamped. The remainder of the operation is on the lines usually laid down, but the author considers that if the ureter is involved it should also be excised and the cut end turned into the bladder. The 11 cases thus treated have recovered. H. A. Kelly (*Jour. Amer. Med. Assoc.*, May 19, 1900).

Vaginal hysterectomy is the safest procedure; in the case of a movable uterus and a circumscribed cancer the mortality is almost *nil*. The main purpose is to anticipate the infiltration of neighboring tissues, which is always sec-

ondary to the growth and which, if the operation is a timely one, can always be achieved. M. G. Richelot (Wiener med. Blätter, Sept. 20, 1900).

*Palliative Treatment.*—When a radical operation is inadmissible, the diseased area may be thoroughly curetted and cauterized with the strong solution of chloride of iron or a 50-per-cent. solution of zinc chloride, applied on a pledget of cotton placed against the wound and held in place for twelve hours by a gauze tampon.

Hæmorrhage and odor from the ulcerated parts can, for a time, be controlled by strong astringent and antiseptic injections. A 1 to 500 solution of chloride of zinc acts both ways, as does permanganate of potassium. The strength is limited by the toleration of the vagina and vulva.

Calcium carbide is valuable for its anæsthetizing influence, for its remedial effect upon the offensive discharge, and especially for its efficacy in controlling hæmorrhage. It may be blown over the surface of the cancer, or pieces of it may be placed in the crater-like portions and covered with a tampon. The healthy portion of the vagina should be protected from its effects by covering it with a tampon saturated with glycerin. W. Grusdew (Münchener med. Woch., June 12, 1900).

Anodynes should be given freely for pain, commencing with the milder ones and ending with opiates. They do less harm than does the suffering. The general treatment should be a supporting one.

**Corpus Uteri.**—Three varieties of carcinoma of the endometrium have been described: adenocarcinoma, malignant adenoma, and squamous-cell carcinoma.

The adenocarcinoma is similar to adenocarcinoma of the cervix, and affects the mucous membrane quite extensively before deeply infiltrating the uterine walls.

Malignant adenoma commences as an enlargement and folding of the gland-tubules, while still lined with a single layer of epithelium. The folds of contiguous glands unite and form anastomosing tubules filled with epithelial cells, which begin to proliferate atypically, and gradually distend and break through the tubules, to form the ordinary nest-structure of cancer.

Squamous-cell carcinoma may occur as a primary growth in those cases in which the epithelium of the endometrium has become squamous in character, or it occurs secondary to squamous epithelioma of the cervix.

The uterine wall is slowly invaded, and the glands of the broad ligament and along the internal iliac vessels become infected. When the changes have passed through the uterine walls, peritoneal adhesions and infiltrations of the broad-ligament connective tissue are formed.

**SYMPTOMS.**—Watery and bloody discharges, gradually becoming offensive and mixed with small particles of broken-down tissue, are the first symptoms. Pain becomes prominent in the advanced stages. If discharges and disintegrating masses of tissue are retained, it is colicky in character, but in time those of chronic peritonitis assume prominence. Pains shooting into the iliac regions and down the limbs also become troublesome after extensive infiltration has taken place.

**DIAGNOSIS.**—The offensive and irregular bloody discharges beginning at or after the menopause, the character of the pains and the progressive nature of the symptoms arouse suspicion. Microscopical examination of the tissue brought out by a curette should always be made.

**PROGNOSIS.**—The prognosis is better than that of carcinoma of the cervix; the surrounding tissues are not as rap-



idly infected. An early operation often effects a cure.

**TREATMENT.**—The only indication is hysterectomy. Abdominal hysterectomy would seem to have the preference, since affected glands of the broad ligament and at the pelvic brim can be seen and enucleated. If the surrounding glands are affected the disease may be expected to return even though the visible ones be removed; hence the only benefit of abdominal over vaginal hysterectomy is that the return may be somewhat slower. Therefore the former is only to be chosen when the conditions are such that the risk would be but little greater: *i.e.*, when the vaginal method presents some unusual difficulties.

Vaginal hysterectomy is performed the same as for carcinoma of the cervix, except that the incisions can be made close to the cervix, and that the Fallopian tubes and as much of the upper portions of the broad ligaments as possible should be taken.

Curettage is only palliative, and should be done with a sharp curette without pressure against the friable uterine walls. Carbolic acid, the solution of perchloride of iron, or a 50-per-cent. solution of zinc chloride should then be applied freely to the uterine cavity.

After-results in 40 cases of vaginal hysterectomy: 1. In a certain proportion of cases patients suffering from cancer of the uterus may be relieved by operation for periods of many years; in some cases for so long a time—seven years and upward—that there seems some probability that the relief may be permanent. 2. The proportion of cases in which this result can be expected must remain very small so long as patients generally only seek advice at a late stage of the disease. 3. Consequently the great *desideratum* is early diagnosis. Improvement in this direction depends to some extent on a better

appreciation on the part of women themselves of the early symptoms of the disease, and especially of the significance of bleeding after the menopause, or of bleeding occurring at an earlier time of life between the menstrual periods. A. H. N. Lewers (*Lancet*, Jan. 5, 1901).

The writer strongly opposes vaginal hysterectomy for cancer of the cervix uteri except in the presence of obstacles necessitating such a course, *i.e.*, a very stout abdomen, nephritis, or old age. The abdominal operation offers an increased space for necessary manipulation, greater security against hæmorrhage, and less risk of injuring the ureters; one is also better able to keep beyond the area of diseased tissue; a larger portion of the broad ligaments together with their lymph channels can be excised and the individual glandular enlargements noted and removed. Injury to the ureters is not so liable to happen because of the better exposure of these structures. In carcinomata uteri the author does not believe that it is necessary to dissect out the iliac glands, as the additional mortality from operation is not repaid by a lessened recurrence. Extension downward into the vaginal epithelium, forward into the bladder, and backward into the rectum, is much more common than metastases into the iliac glands. Cancer of the body of the uterus requires complete hysterectomy and in the early stages the organ may be removed through the vagina. J. B. Deaver (*Amer. Jour. of Obstet.*, Jan., 1904).

**Deciduoma Malignum.**—Malignant degeneration of the placental part of the chorion sometimes takes place, giving rise to a growth that has, as yet, not been sufficiently studied to enable us to give it a definite place in pathology. At present most authors consider it as a carcinoma of the chorion that seems to involve mainly the ectodermal and syncytial layers. It is composed of polymorphous and giant epithelial cells imbedded in connective tissue.

It more often originates after labor or

interrupted pregnancy, either uterine or extra-uterine, or after the expulsion of an hydatidiform mole.

It is characterized by extreme malignancy, rapidly invading the uterine walls and broad ligaments and producing metastatic deposits in distant organs.

**SYMPTOMS.**—The symptoms are abundant, repeated hæmorrhages, offensive discharges, and rapid enlargement of the uterus. When occurring near a labor or abortion, the uterus seems to remain enlarged, and a curettage to remove the supposed remains of the placenta produces only temporary relief.

**TREATMENT.**—The treatment consists in an early hysterectomy, the rapid development leaving no time for hesitation or delay. If the uterus is not much enlarged, it may be removed by vaginal section; but, if much enlarged and softened, by the abdominal method.

**Sarcoma of the Uterus.**—Sarcoma of the uterus occurs as a papillary or polypoid growth on the cervix, as a diffuse growth on the endometrium, and as an interstitial tumor.

The disease is very rare, and may occur at any age.

**SARCOMA OF THE CERVIX** contains round and spindle cells. It is soft and usually papillary in structure, and projects in polypoid masses from the vaginal portion until it fills the vagina and exerts pressure on the rectum and bladder. It spreads into the cervix and uterine cavity and into the connective tissue and peritoneum about the cervix.

*Symptoms and Diagnosis.*—The symptoms are abundant hæmorrhage and irritating and offensive discharges. Retention of urine, difficult defecation, and expulsion of dark-colored, offensive masses from the cervix soon become noticeable. Anæmia and cachexia develop sooner or later, pelvic neuralgic and peritoneal

pains supervene, and finally death ensues from exhaustion or peritonitis.

The diagnosis is made by the microscope, although youth of the patient, the predominance of early hæmorrhage, and the abundance of dark, soft, polypoid masses hanging from the cervix indicate the nature of the disease. The hydatid mole does not break down or bleed as easily, and can be braced into the uterine cavity.

**SARCOMA OF THE ENDOMETRIUM** belongs to the round-cell variety. It is usually a diffuse papillary growth, and fills the uterine cavity with a soft, brain-like substance that may project into the vagina. The uterine walls become infiltrated, and finally the surrounding organs also.

The symptoms are watery discharges, and later profuse hæmorrhage, becoming offensive and mixed with pus. Anæmia, septicæmia, and pelvic pains become prominent.

The diagnosis may sometimes be made from the abundance of the hæmorrhage, character of the tissue that can be scooped out of the uterus, the uterine enlargement, and the general symptoms of malignant disease, although the tissue should be examined under the microscope.

**INTERSTITIAL SARCOMA** resembles intramural myoma in appearance, and consists of round and spindle cells, largely of the latter. It may occur as circumscribed nodules or as a diffuse growth of spindle cells. The submucous tumors sometimes become polypoid. Some are supposed to have been myoma that have undergone sarcomatous degeneration. Rarely they originate in the cervix.

*Symptoms.*—The symptoms are similar to those of myoma uteri, but they grow more rapidly and are attended later by offensive discharges. Early menorrhagia



is apt to be less prominent than those from myomas. Pain and the general symptoms of malignancy are late in appearing.

*Diagnosis.*—The diagnosis is based upon its variation from myoma, on the one hand, and carcinoma or sarcoma of the endometrium, on the other. It grows faster than myoma, but does not become very large before it causes symptoms of malignancy. However, it enlarges the uterus more than carcinoma or sarcoma of the endometrium before causing pain, cachexia, offensive discharges, etc.

Personal analysis of 2649 consecutive cases of primary uterine neoplasms discovered only 2 sarcomas, and in Gault's analysis of 4115 uterine neoplasms were only 8. W. Roger Williams (Brit. Gyn. Jour., May, '97).

The *treatment* of all forms of sarcoma is hysterectomy according to methods described for carcinoma and myoma. Owing to the tendency to spread by way of the circulation to distant structures, the operation should be early and radical.

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## V

### VAGINA AND VULVA, DISEASES OF.

#### Diseases of the Vagina.

It is not strange that an organ which is subject to excessive use and abuse as the vagina should be so susceptible to disease and injury. This organ is an essential part of the parturient canal; sexual passion, in love or licentiousness, is concentrated upon it; and its relation to the other pelvic organs is so intimate that it is quite certain to bear a larger or smaller share of the ills which they experience.

#### Vaginitis.

The inflammatory affections of the vagina may be divided into the (1) traumatic and (2) infectious.

#### Traumatic Vaginitis.

*Symptoms.*—Pain, swelling, local elevation of temperature and congestion are distinguishing symptoms. Even moderate pressure, the introduction of a speculum, or violence of any kind may cause great pain and more or less bleeding. The acute symptoms are usually of short duration, and may disappear in a few days with judicious treatment. An inflammation in such vascular tissue as the

vagina is easily excited, and its abundant lymphatic supply and large absorbent surface demand that the conditions be kept as aseptic as possible. Especially in those cases in which there is suppuration or sloughing should one remember the possibility of converting the case from one of simple inflammation to one with infectious and constitutional elements.

*Etiology.*—This, like the kindred vulvar disease, may be accidental or intentional. The former, as in the vulvar disease, may arise from violent and brutal coitus, from the thrust of sticks or other substances of wood or metal, from violent and unskillful attempts to produce abortion, from prolonged or complicated parturition, and from the caustic effect of heat and chemicals.

The infectious variety may proceed from wounds inflicted by the surgeon (*e.g.*, those which are made to facilitate delivery), from strangulation of tissues which have been too tightly ligated in the repair of vaginal injuries, or from the actual or potential cautery.

Vulvo-vaginitis in the young girl may be divided into simple and gonorrhœal. Simple catarrhal vaginitis is due, in a

large majority of cases, to lack of cleanliness, and subsides when the proper treatment is instituted. Gonorrhœal vulvo-vaginitis in young children is more common than is generally supposed. While more frequently met with amid unhygienic surroundings in large cities, it is by no means a rarity in the less thickly settled districts. Gonorrhœal disease is more frequent below the age of six; it is more common in girls than in boys. Specific vulvo-vaginitis in the large majority of cases arises from actual contact of the patient with some infected person. A study of the reported epidemics, however, shows that the disease may be spread by other means, such as a common bath, towels, bed-linen, etc. The ordinary staining methods will prove satisfactory in making a differential diagnosis between specific and other forms of vulvo-vaginitis. The parts affected in their order of frequency are the labia, urethra, vagina, and cervix; the vagina is more frequently affected in the child than in the adult, owing to the character of its epithelium. The tubes, ovaries, and peritoneum may be involved in the pathological process. It is not improbable that certain diseases of adult life may be ascribed to gonorrhœal infection in infancy. Purulent ophthalmia and rheumatism are quite frequent complications. The strictest prophylaxis should be observed in order to avoid the former. The treatment of specific vulvo-vaginitis must be energetic to be of any avail. Under certain conditions the vaginal orifice should be widely dilated and the vaginal pus-cavity properly drained. Peterson (Amer. Medicine, Jan. 11, 1902).

**Treatment.**—Simple measures of treatment are always the most effective. Gentleness of manipulation will be helpful; harshness will prolong the unfavorable conditions. Douches with hot saline solution or weak solution of lead and opium (U. S. P.) will serve the double purpose of cleanliness and relieving pain. The douches may be repeated twice daily and in the interval a pad of absorbent cotton may be secured against

the vulva and kept moist with the lead-and-opium wash. The bowels must be kept open with salines or any approved mild cathartic. Rest in bed will hasten the termination of the inflammatory process.

When extensive ulceration is known to exist in the vagina, the case should be examined from time to time until the ulcers have healed, so that the exact condition can be determined and the proper steps taken, if necessary, to prevent stenosis. When caustics are to be used in the vagina, the healthy portion of the mucous membrane should be protected by vaselin, only cauterizing that portion which is absolutely in need of it. When a tumor has been removed from the vagina, or other operation done, where a section has been removed, the case should be examined after healing is complete, to ascertain the condition and extent of the cicatricial tissue. Lacerations of the vagina occurring during labor should be closed immediately, if possible. F. D. Thompson (Hot Springs Med. Jour., Jan. 15, '96).

### Infectious Vaginitis.

If the inflammatory condition has an infectious origin, the causes may be varied and distinct. There are few germs or microbes which normally find their habitat in the vagina. An acid mucus, the normal secretion of its mucous membrane, acts as an effectual antiseptic barrier, in many cases, to the attacks of microbes; otherwise the morbidity of this organ would be even much greater than it is. The following varieties of infectious vaginitis are well recognized:—

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|------------------|--|
| 1. Venereal      | $\left\{ \begin{array}{l} \text{Gonorrhœal.} \\ \text{Chancroidal.} \\ \text{Syphilitic.} \end{array} \right.$ |
| 2. Tuberculous.  |  |
| 3. Diphtheritic. |  |
| 4. Puerperal.    |  |
| 5. Eczematous.   |  |

This classification, it will be observed,



is not very dissimilar to that hereinafter suggested for infectious vulvitis.

### Venereal Vaginitis.

**Symptoms and Etiology.**—Gonorrhœal infection of the vagina has been carefully investigated since Nöggerath published his epoch-making paper in 1869, and the subsequent discovery, by Neisser, of the gonococcus. The infection is seldom limited to the vagina, the disturbance being shared by the vulva and uterus, and not infrequently by the uterine appendages and the peritoneum. It may be acute or chronic, and repeated acute attacks are not unusual. The symptoms may begin within twenty-four hours of the reception of the infectious material, or they may be deferred for five or six days. The disease is usually the result of coitus, but it is sometimes due to soiled towels, instruments, or fingers. No age is exempt from it, but it is most common with women from twenty to thirty years of age, when the tissues have their greatest activity and vitality. It rapidly spreads from the point of infection to the contiguous epithelium, until the entire vagina may be involved. There may be infiltration of the subepithelial structures, but the epithelium and the superficial vessels are chiefly involved. Congestion, pain, and swelling are noteworthy, but there may be little constitutional disturbance. The mucous membrane is dry for two or three days and bleeds readily; then there is a purulent discharge for several days and the severe symptoms gradually subside.

**Treatment.**—Rest in bed and alkaline diuretics, as:—

℞ Sodæ benzoat., 5 drachms.  
Fl. ext. buchu, 4 drachms.  
Tinct. hyoscyami, 5 drachms.  
Aq. gaultheriæ, ad 4 ounces.

M. Sig.: Teaspoonful in water after meals.

Saline cathartics (Congress water, Hunyadi, or Rubinat, a glass before breakfast) are also indicated.

Local applications are very painful, and should be deferred until the discharge begins to flow. A well-lubricated speculum should then be carefully introduced into the vagina and opened as freely as the painful condition will permit. The entire mucous membrane may then be gently swabbed with a 10-per-cent. solution of nitrate of silver or a 2-per-cent. solution of protargol. This should be repeated daily as long as the discharge persists. Excessive or meddling treatment will intensify the symptoms, and it is better to wait for the subsidence of the acute stage than be overzealous and inflict great pain. It is hardly necessary to say that the instruments and the hands of the physician must be rigorously cleansed after treating such a case. Chancroidal and syphilitic vaginitis usually mean the characteristic sores or ulcers upon the vaginal mucous membrane. It may be difficult to differentiate them, as there may be only a mucous patch or superficial ulcer, which will often be found near the entrance of the vagina. Whether the disease is local or constitutional will usually be determined by other symptoms. Nothing better can be suggested than cleanliness and the use of nitrate-of-silver solution for the healing of these sores, but the walls of the vagina can be kept apart with a tampon of cotton-wool moistened with a 2-per-cent. solution of ichthyol in glycerin. Douches with hot creolin solution (1 or 2 per cent.) may also be used morning and evening.

Protargol recommended as a local remedy for vulvo-vaginitis in children. The strength of solution indicated depends on the degree of inflammation and other cir-

cumstances, but 2 per cent. in gonorrhœal cases and 1 per cent. in others represent good guides as to dilution. For very sensitive mucous membranes a weaker solution may be necessary. The pus is first wiped from the orifice of the vagina, which is then gently syringed with a 5-per-cent. solution of sodium bicarbonate until no more pus can be washed out. From  $\frac{1}{2}$  to 1 ounce of the protargol solution is then introduced by means of a syringe and soft-rubber catheter, and is retained in the vagina about five minutes. This process is repeated from three to five times daily. H. B. Sheffield (N. Y. Med. Jour., lxxii, p. 189, 1900).

### Tuberculous Vaginitis.

**Symptoms.**—The character of the disease is that which is peculiar to miliary tubercle upon mucous membranes in general, the tubercle being a localized lenticular mass varying in size from a pin's head to a pea, slightly raised above the surface, grayish in color, quickly breaking down and forming a ragged ulcer with infiltrated walls, neighboring ulcers frequently coalescing and showing slight tendency to heal. There may be only a small number of tubercles or the vagina may be studded with them. They are painful to the touch, secrete a sanious discharge, which excoriates tissues with which it is brought in contact, and should be differentiated from the ulcerative lesions of venereal vaginitis. Acute local symptoms are usually wanting. The many avenues for transmission of the tubercle bacillus from the vagina to other parts must not be forgotten, nor the ease with which general infection may follow the local one in the vagina.

**Etiology.**—This is one of the rarest forms of tubercular disease, but its existence is affirmed by competent authority. It is rarely an isolated process, being usually an element in disseminated tubercular infection. It may be

communicated during coitus from a tuberculous ulceration of the penis.

**Treatment.**—The treatment must be both constitutional and local, the former embracing such means as are usually administered in tuberculosis, iron, oxygen, creasote, codliver-oil, alcohol, and an abundance of nourishing food; the latter consisting in cleanliness, creolin douches (1 or 2 per cent.) twice daily, and local applications of a 10-per-cent. solution of nitrate of silver or of the mineral acids in moderate strength. The object of the local applications, it must be remembered, is to stimulate the tissues to healthy activity, and to prevent spreading of the ulcerative process, *not* to cauterize the tissues.

### Diphtheritic Vaginitis.

**Symptoms and Etiology.**—This condition implies the deposit of an exudate and the formation of a fibrinous false membrane, as in the similar process upon a mucous membrane in any other part of the body. This membrane is a grayish, sloughy formation similar to that which is so frequently seen in the pharynx. Its development is attended with the usual symptoms of acute inflammation, and forcible treatment of it will be attended with pain and hæmorrhage. It may occur either in children or in adults. It has been observed in connection with pharyngeal diphtheria, with the eruptive fevers, and with puerperal septicæmia. It is a symptom of grave importance whatever its associations may be, for it indicates a septic condition which is usually profound and general.

**Treatment.**—The constitutional treatment must be that of the disease of which the vaginitis forms but a part. It must be supporting and tonic, and may include iron in an assimilable form



(Blaud's pills, the peptomanganate, tincture of the chloride, etc.), strychnine, quinine (the elixir of iron, quinine, and strychnine is a useful combination), milk, and nourishing broths. Alcohol (whisky, port, sherry, or champagne) is usually indicated, both for its stimulating and its antiseptic effects. The value of alcohol in these depressing, toxic conditions can hardly be overestimated. For local treatment little should be attempted beyond perfect cleanliness. When the membrane begins to disintegrate or exfoliate, it should be gently removed with dressing-forceps, and hot antiseptic douches (creolin, 2 per cent., at a temperature of about 100° F.) should be given twice daily as the conditions warrant.

#### **Puerperal Vaginitis.**

**Symptoms and Etiology.**—This condition, which forms a part of the diseased puerperal condition formerly known as puerperal fever, may include the condition which has previously been described, though puerperal vaginitis is not necessarily—indeed, is not usually—diphtheritic.

It may occur to puerperal women of any age or social grade, to rich or poor. In surroundings which are manifestly dirty and with doctors or midwives who are plainly careless or neglectful it is most frequently encountered, but it sometimes occurs when the precautions on the part of doctor and nurse have been most rigid and complete.

The infecting material may be received in the vagina itself or in the vulva or uterus, the infection extending to the vagina. It may be the streptococcus or the mixed streptococcus and staphylococcus, or organisms of lower virulence. The local vaginal symptoms may not be acute, for the disease is seldom limited to the vagina, or there may be the symp-

toms of an ordinary infectious vaginitis which have been noted in the foregoing pages.

**Treatment.**—The treatment is such as would be appropriate with diphtheritic vaginitis, and need not be repeated. Cleanliness and antiseptic douches are the chief measures for reliance. Apart from these, the vitality of the patient will determine whether the progress of the disease and its outcome will be favorable or unfavorable.

#### **Eczematous Vaginitis.**

**Symptoms.**—It runs no well-defined course, its most noteworthy symptom being an acrid watery discharge, which excoriates the skin of the external genitals, causing great distress and annoyance from persistent itching. The itching may extend to the vulva and perineum; the vaginal mucous membrane may be swollen, sensitive, and congested, and attempts to relieve it by friction often intensify the irritation. Constant rubbing will sometimes produce great annoyance from the provoking of sexual feeling, and this is the more regrettable because of its inappropriateness in those who are of mature or advanced years.

The discharge and irritation may extend to the mucous membrane of the uterine canal, in which case the treatment must include that organ.

**Etiology.**—Eczematous vaginitis rarely occurs except in women who have passed the menopause. It has often been described under the nomenclature of senile vaginitis. It is almost invariably associated with eczema of the vulva, which is hereinafter considered.

The cause, so far as I can ascertain, has not yet been detected, though it is probably a vegetable germ. In my experience it is quite a common disease and has been observed the more fre-

quently among those who are not over-particular in their personal habits.

**Treatment.**—Treatment should consist in careful cleansing of the vagina with 10-per-cent. solution of nitrate of silver applied upon a swab of absorbent cotton to *every portion of the mucous membrane*. An ample tampon of cotton-wool moistened with the paste of glycerin and bismuth (mentioned in connection with diseases of the vulva) should then be placed in the vagina, the relief being almost always definite and satisfactory. The applications must be made daily until the congestion and discharge have entirely ceased, and sedative and astringent douches should be used daily before the tampon is renewed. In case the constitutional symptoms in a given case are severe it would, of course, be inappropriate to carry out the local treatment with regularity. Common sense must be the guide, and, if the disturbances caused by local interference were likely to be greater than the advantages to be gained, the former should stand aside for the time.

### Leucorrhœa.

There is scarcely any morbid condition from which women suffer which is more common than leucorrhœa. By this term is meant the fluid discharge, more or less sticky, more or less purulent, milk-like in appearance, variable in quantity, and sometimes offensive in odor, which may occur at any age and in any social condition. The vaginal discharges from those forms of inflammation which have been described are excluded. The condition which causes the discharge is not an inflammatory one, in the broadest sense of the term, but an irritative one, in which there is excess of secretion from the vaginal epithelium, and probably transudation of serum and corpuscles from the vaginal blood-

vessels, at least in some cases. The discharge is the more profuse as the tension in the blood-current is increased: therefore just before and just after the menstrual flow.

**Symptoms.**—While it must be admitted that leucorrhœa is a symptom, it is also the direct expression of a diseased condition, and it produces a variety of unpleasant results. The daily discharge may amount to several ounces, and the removal of this volume of fluid, especially in those who are already debilitated, may add materially to the existing condition of weakness. It may also produce an intense irritation of the skin which it soils, causing itching and pain, which may become almost unbearable.

**Etiology.**—Among its many causes may be mentioned: 1. Conditions in which the freedom of the pelvic circulation is impaired; *e.g.*, pregnancy, new growths, and inflammatory conditions within the pelvis. 2. A relaxed and catarrhal condition of the mucous membranes in general; *e.g.*, anæmia, fatigue, and the catarrhal diathesis. 3. Excessive function; *e.g.*, frequent coitus.

**Treatment.**—The treatment consists first in cleanliness, the discharge being received upon absorbent-cotton pads as soon as voided; next in relieving, as far as possible, the conditions which have caused it; and, finally, in the use of astringent douches, such as have frequently been referred to, to remove, as far as possible, the local conditions which favor its continuance.

The vaginal secretion having an acid reaction led to the conclusion that this acid possessed bactericidal properties; experiments showed that profuse and foetid leucorrhœa under irrigation with a 3-per-cent. solution of lactic acid disappeared in a very short time. Sneguireff (*Münchener med. Woch.*, S. 66, 1900).

Except in a few instances, such as



specific and septic infections, leucorrhœa is almost always secondary.

Speaking broadly, the discharge can have its origin in one of three places: (1) the vagina, (2) the cervix, and (3) the endometrium of the body of the uterus.

When a patient presents herself complaining of leucorrhœa, the first thing to do is to determine the cause, if possible. Any local treatment would be worse than useless, unless the source of the trouble be removed at the same time.

It has been personal custom to treat by the use of tonics for the general health, astringent douches of alum and zinc sulphate, and the occasional use of a solution of silver nitrate, 10-20 grains to 1 ounce. This latter is applied by inserting a cylindrical speculum, filling it full of the solution, and then slowly withdrawing the instrument, thus making sure that the solution reaches every part of the vaginal wall. This is more satisfactory than the use of a swab. This treatment, combined with douches of corrosive sublimate 1 to 4000, is the one which, in gonorrhœa, has given perfect results.

Cervical leucorrhœa, always excluding a gonorrhœal infection, is usually due to a catarrhal inflammation of the cervical endometrium, usually secondary to some other condition. The discharge here is very thick and copious. It is often accompanied by erosions of the cervix. This erosion, when not due to laceration, is produced by swelling and prolapse of the cervical endometrium. When such an endometritis exists, it usually involves the corporeal endometrium as well, so that the condition may often be cured entirely, or at least form a much better foundation for satisfactory after-treatment, by a thorough curettement. Non-operative treatment consists in *hot* astringent douches, painting the vaginal vault with Churchill's tincture of iodine, and the use of boroglyceride tampons three times a week, the whole combined with a general tonic treatment. Tonics are generally indicated. The only precaution taken is not to prescribe iron in cases where there is a tendency to uterine hæmorrhage.

When this treatment has not the desired effect, protargol bougies may be used.

Leucorrhœa from the uterine body is nearly always associated with an endometritis. The treatment should be curettement to remove the hypertrophied masses; then tonic treatment with intra-uterine medication of one of the new silver salts in the form of bougies. Barton Cooke Hirst (Ther. Gaz., Oct. 15, 1900).

### Atrophy of the Vagina.

This condition is the natural result of age and the decay of function; it is a diseased condition when it occurs prematurely, or as the result of other diseased conditions. It occurs after the removal of the ovaries and the premature production of the menopause; sometimes in connection with excessive obesity and wasting diseases, which cause atrophy of all the genital organs. The lumen of the vagina, under these conditions, is contracted, the mucous membrane is pale, and it fails to respond to those stimuli to which the healthy mucous membrane ordinarily reacts. In a word, its vitality as a functioning organ is practically abolished. No particular treatment is indicated, its work as an organ being accomplished.

### Hypertrophy of the Vagina.

Excessive use, as in all organs of the body, will cause hypertrophy of the vagina. Its walls may merely be thickened or they may be disposed in folds and ridges. It may be due to excessive child-bearing, excessive coitus, or to an accumulation of fat and connective tissue, which is part of a general process. If it is unattended by prolapse, it may give rise to no disagreeable symptoms, and consequently calls for no particular treatment.

### Prolapse of the Vagina.

This condition of the vagina may exist without hypertrophy, but is usually asso-

ciated with it. Either the anterior or the posterior wall or both may be prolapsed. The conditions which cause hypertrophy are also in most cases the cause of prolapse.

**Treatment.**—The treatment may be palliative or radical. The former consists in the use of pessaries, electricity, or astringent substances to contract the redundant tissues. Though this may be effective for the time, the moment the treatment is discontinued the unfavorable conditions will recur. Hence radical surgical measures are to be recommended as preferable. Such measures consist in the removal of superfluous tissue and the restoration of the vagina to its normal condition. Various operations have been suggested for this purpose, but I shall describe only those which have been of greatest service in my own experience. For prolapse of the posterior wall the simplest operation and the one which will be applicable to the greatest number of cases is that which was devised by Hegar. It consists, in brief, in the removal of a triangular or nearly triangular strip of the vaginal mucous membrane, the apex of the triangle being near the os uteri and the base at the introitus vaginae. The size of this triangle must be regulated by the degree of prolapse and the width of the vaginal wall. By depressing the vaginal wall in its middle line with a sound and drawing the mucous membrane over it on either side until the necessary amount of slack has been taken up, the sides of the triangle may be determined. Having outlined the sides by incision with a scalpel uniting them as near the os uteri as the redundancy of the tissue demands, grasp the tissue at the apex and dissect downward as rapidly as possible, removing as little of the submucous tissue as is convenient, and remembering that the

rectum lies immediately under the vagina, and that it is very undesirable to enter it. The hæmorrhage is sometimes very profuse, but it can generally be checked by pressure with gauze pads. The junction of the mucous membrane of the vagina with the skin of the perineum may form the base-line of the triangle, the tissue being removed to this junction. The wound may then be irrigated with hot saline solution, and then covered with a very hot gauze pad or sterilized towel until the sutures are ready for insertion. Fine aseptic catgut (No. 1 or No. 2) may be used and a sharp-pointed half-round needle an inch and a half or two inches long. The sutures may be interrupted or continuous, the latter being introduced the more easily and quickly. It is essential that the edges of the wound be carefully approximated to each other. The denuded area having been closed, a gap in the skin of the perineum will remain as the result of bringing the ends of the base-line together. This may be closed with three deep, interrupted sutures which must make a sufficiently broad sweep in the perineum to draw forward the retracted muscular tissue. If the injury is of long standing, much of the original muscular tissue of the perineum will have atrophied; much of it may have entirely disappeared. It will therefore be a futile task to attempt to recover by dissection that which does not exist, or seldom exists,—namely: the muscles of the perineum,—as they were related and disposed prior to the accident which tore them apart, exposed them, and was followed by degenerative changes. The entire wound may then be irrigated, dried, and covered with a thin film of iodoform collodion, the vagina then receiving a light dressing of iodoform gauze, while the wound is protected outwardly by ab-



sorbent cotton and a T-bandage. Perfect cleanliness of the wound for the succeeding week, the patient being kept quietly in bed upon her back, with legs tied together, will favor a successful result. It is not insisted that failure will follow less rigorous measures. I have found that the extra trouble and self-denial on the part of the patient usually paid. Ten days or two weeks in bed will usually suffice. Instead of catgut for the perineal sutures one may use worm-gut or silver wire with good satisfaction. They cause a little more trouble in introduction and require removal when the wound is healed; that is, in ten days.

For prolapse of the anterior wall a method of treatment by an operation which was devised by me several years ago is suggested (*Annals of Gyn. and Ped.*, vol. iii, p. 516, '90). It is assumed that the prolapse of the vaginal wall is extensive, an elliptical strip of mucous membrane is removed from the long axis of the vagina, the vaginal wall being depressed with a sound (as in Hegar's operation on the posterior vaginal wall) to determine the extent to which the redundant tissue is to be removed. Then another ellipse, sufficiently large, is removed at right angles to the first, the plane of each ellipse cutting that of the other at its middle. With suitable precautions against hæmorrhage, the edges of each quadrant (or half-ellipse) in the denuded area are then united from end to centre with aseptic catgut, the ends being carefully tied to close with neatness the central portion of the wound, which may show a tendency to gape. Iodine collodion is then applied to the wound and iodoform-gauze dressing in the vagina. After rest in bed for ten days and perfect cleanliness, it will

usually be found that the wounds have healed by first intention.

Complete removal of the vagina and uterus for those extreme cases of prolapse of the uterus and vagina which resist all other treatment, including colporrhaphy. The stages of the operation are as follow: 1. A circular incision is carried through the vagina at the former site of the hymen, about  $\frac{1}{2}$  centimetre behind the orifice of the urethra in front. 2. A vertical incision is made in the posterior vaginal wall up to the fold of peritoneum forming Douglas's pouch. After ascertaining the position of the rectum, six sutures are passed through the skin-margin of the circular incision, on the one hand, and through the peritoneum of Douglas's pouch, on the other, whereby the peritoneum is firmly joined to the external skin. 3. Anterior colpotomy is then performed, the bladder and urethra are separated from the vagina, and the plica peritonei anterior opened and sutured to the anterior part of the incision, whereby the bladder is raised and pushed forward. 4. The lateral wall of the vagina is then raised from the underlying tissue as far as the cervix, the broad ligament is ligatured, and here also the peritoneum is sutured to the lateral part of the circular incision. After doing this on both sides, there is a funnel-shaped cavity where the uterus and vagina formerly were, which is completely covered in by peritoneum, and by the tension of the remains of the ligaments the margins of the vulva are drawn tightly inward and upward. The external opening of this peritoneal funnel at the vulva is then closed by sutures, which draw the edges of the circular incision together, and the peritoneal surfaces in contact at the sides. This operation has been personally performed in ten cases, and always with most satisfactory results. A necessary condition for success is that the vagina be excised completely, right up to the hymen. A. Martin (*Berl. klin. Woch.*, Oct. 3, 10, '98).

#### Vaginismus.

This term was used by Sims, Thomas, and others to denote an excessive degree

of hyperæsthesia, together with spasm of the muscles which form its outer wall and which render any contact with the vagina annoying or even positively painful. Hyperæsthesia of the vulva or of the vagina is a better term, as this is the significant condition. The trouble may often be referred to the sensitive remains of the hymen, which may not bear the slightest pressure or even suggestion of pressure without exciting painful emotion and spasm.

**Treatment.**—The induction of general anæsthesia, dilatation of the introitus vaginæ and excision of the ring of tissue which is the remnant of the hymen will usually cure the trouble. The hæmorrhage attending such an operation may be profuse, and it is always desirable to tie all bleeding vessels and preclude subsequent hæmorrhage by the pressure of a tampon filling the entrance of the vagina.

#### Fistulæ and Tumors.

Fistulæ communicating with the vagina may also communicate with the bladder, uterus, ureter, intestine, rectum, or pelvic connective tissue. They are most frequently the result of a prolonged and difficult labor, but they may also result from sepsis following surgical operations and from inflammatory disease of the pelvis in general. Uretero-vaginal and uretero-utero-vaginal fistulæ are rare; so also is uretero-vaginal fistula, the latter following rupture of the uterus. Entero-vaginal fistula may follow hysterectomy, removal of the appendix, or any complicated operation within the pelvis in which the intestine, including the rectum, has been injured. This form of injury has become more frequent since the removal of diseased structures by way of the vagina became an approved method of procedure.

A vaginal fistula means the passage of

urine, fæces, or pus into the vagina by way of a canal connecting with the bladder, intestine, or an abscess within the pelvis. It is a very distressing condition, and the problem involved is to obliterate this canal. Such a problem is usually difficult and is subject to frequent failures.

**Treatment.**—A cure will sometimes result spontaneously; but, if so desirable an issue is wanting, the cure can only be obtained by surgical measures.

Two classes of cases may be considered: those in which the fistula alone is to be regarded and obliterated and those in which this procedure alone will not suffice, the organ, or abscess, or tissue having communication with the vagina requiring separate treatment or removal.

In the first class may be mentioned the fistulæ communicating with the bladder, rectum, and ureter, and some of those which connect with the uterus, intestine, and pelvic connective tissue. In the second class are those which connect with the tubes and ovaries, intestine, appendix, and pelvic tissue. For the first class of cases the lines of treatment have been clearly defined by many writers. They require that the vaginal mucous membrane be carefully and broadly denuded, the adhesive attachment between the vagina and the other injured organ being usually maintained. The denuded tissues are then brought into such accurate apposition that no leakage can occur. For suture material in such cases I believe that nothing has been discovered which is equal to fine pliable silver wire. Each suture is carefully twisted so as to furnish an adequate splint to the tissues during the process of healing, but care must be taken that it be not twisted too tightly, thereby defeating the very object of uniting the denuded surfaces.



The sutures are to be retained from seven to ten days, and then carefully removed. In vesico-vaginal fistula it has always seemed to me rational and useful to keep a catheter within the bladder for constant drainage as long as the wound remains unhealed.

Personal operation in vesico-vaginal fistula is as follows:—

1. A crescentic incision separating the muscular and mucous coats from the vagina is made around the posterior two-thirds of the fistula, and the bladder detached from the supravaginal cervix all the way up to the peritoneum, and widely on both sides, by a blunt dissection.

2. Next a strip is denuded around the remaining anterior third of the fistula on its vaginal surface, the denudation being carried down to the mucosa of the bladder and the urethra.

3. Two flexible urethral catheters  $2\frac{1}{4}$  millimetres in diameter are passed through the urethra across the fistula, and one conducted into each ureter and pushed up above the brim of the pelvis.

4. The part of the bladder freed from its attachments behind is now easily drawn forward and accurately applied to the immovable anterior third, to which it is united by interrupted fine silk-worm-gut sutures. Each suture catches the under surface of the muscular coat of the bladder so as to turn the cut edge up toward the newly-formed bladder. The urethral orifices fixed on this edge are in this way turned into the bladder, and escape transfixion or compression by the sutures through the presence of the catheters, which make their position plain. These urethral catheters may be left *in situ* for a few days, thus draining each kidney directly through its ureter and preventing any urine from entering the bladder. H. A. Kelly (Johns Hopkins Hosp. Bull., Mar., '96).

Six cases of complicated vesical fistula operated upon successfully by the method described by Freund. Douglas's pouch was opened, the fundus uteri drawn down through the opening, and after freshening the edges of the fistula and the posterior uterine wall near the fundus

the latter was sutured to the bladder, so as to close the fistula.

It is unnecessary to make an opening in the fundus for the escape of menstrual discharge as suggested by Freund. Romm and Kahn (Centralb. f. Gynäk., No. 9, '97).

Forty-four cases of fistula were observed in the hospital at Saratoff among 1004 gynecological cases (4.36 per cent). As regards the results of operative interference, 47.74 per cent. were cured by a single operation; 6.81 per cent. by two; 18.18 per cent. were relieved by diminishing the size of the fistula; episioleisis was successful in one instance; eight patients were not relieved. The denuded surface was always quite extensive, and was made so that the edges could be approximated with the least possible tension. Silk sutures were generally used (rarely silver wire), which were removed on the sixth or eighth day. A catheter was left in the bladder for nine or ten days, after which time the patient was allowed to leave her bed. Anæsthesia was rarely used. Rouzmine (Boln. Gaz. Botkina; La Gynéc., Apr. 15, '98).

In vesico-vaginal fistula the reformation of the bladder-wall is the essential point for cure. After the separation of the flap around the fistula four double threads are passed, thin ends knotted and lying outside the vagina (two only are shown in Fig. 1). A pair of curved forceps is passed through the urethra up to the fistula, and the four pairs of threads are brought together and their knotted ends placed within the grip of the forceps. If gentle traction is made upon these, as is seen in Fig. 2, the circular flap is inverted into the bladder "in such a way that mucous membrane will face the bladder, while the raw connective-tissue surface will face itself and come easily together at the level of the bladder-wall, while the innermost edges project as a tube into the bladder-cavity."

While traction upon these threads is gently maintained, and *before* the frill is inverted, a fine-silk suture is carried round it just above its extremity; this passes through the connective tissue, but must carefully avoid the mucous mem-

brane. This is now cut short, the frill inverted, and the guiding threads divided and drawn out through the urethra. In Fig. 3 the repaired fistula is seen from the vaginal side.

The advantages are: (1) absence of tension upon the uniting surfaces; (2) mucous membrane is alone opposed to

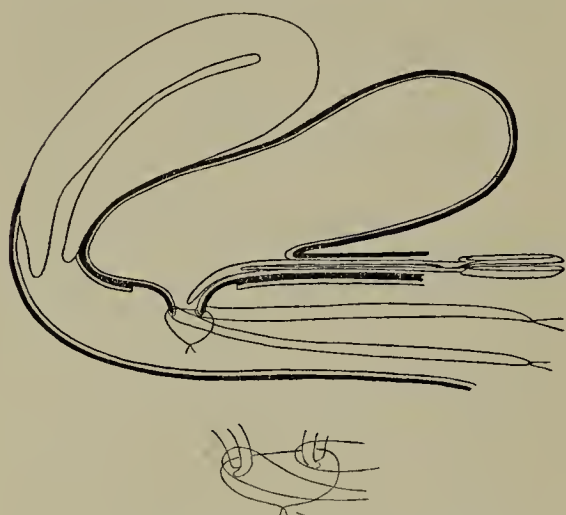


Fig. 1.—The flap has been separated and turned into the vagina; two guiding threads are shown in position, and the first uniting thread, which passes only around through the connective tissue and muscular coat, avoiding the mucosa. A pair of bent forceps is passed through the urethra, its point entering the vulva through the fistula. The guiding threads will be turned up into the vagina and their knots placed between the jaws of the forceps. (*Stanmore Bishop.*)

the action of the urine; (3) the cubic capacity of the bladder is not much decreased, as in other operations for a similar purpose; (4) the sutures are separated from the bladder-contents by the mucous membrane in its entire thickness. *Stanmore Bishop* (*Trans. Med. Soc.*, vol. xx, p. 123, '98).

In the second class of cases not only must the vaginal opening be closed, but the abdomen must be opened and the source of offense removed, whether it be organ or tissue. In some cases the removal of this source of offense will suffice, and the vaginal fistula may be closed by a subsequent operation should it fail to heal after the irritating cause has been removed. In either class of cases a series

of operations may be required, and great patience and skill will be demanded if a cure is to be accomplished.

### Tumors of the Vagina.

The tumors of the vagina, like those of other organs, may be benign or malignant. They may be classified as follows:—

BENIGN.—1. Herniæ. 2. Cysts. 3. Hæmatomata. 4. Non-cystic growths. 5. Foreign bodies.

MALIGNANT.—1. Carcinomata. 2. Sarcomata.

### Herniæ.

Diagnosis.—Hernia of the rectum, or rectocele, is determined by the finger or sound in the rectum, which readily detects the pouch in the vagina formed by the prolapsed organ. Hernia of the bladder, or vesicocele, is similarly determined by a sound within the bladder.

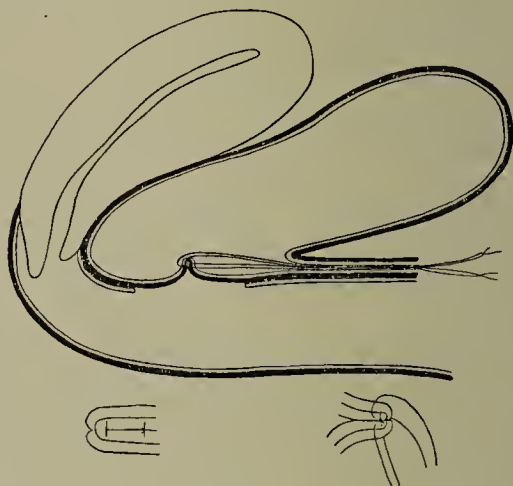


Fig. 2.—The guiding threads have been drawn through the urethra, pulling the circular flap or frill into the bladder. The first uniting thread has been drawn tight and knotted, closing the upper extremity of the frill. This is shown also in enlarged detail. The two uniting threads are shown tied, and the frill thus closed above and below. (*Stanmore Bishop.*)

Prolapse of the vagina is often associated with one or both of these forms of hernia, and the distinction between the two conditions is often overlooked even



by gynecologists of skill and ability. Hernia at the top of the vagina is determined by the presence of a soft, painless, movable tumor, which, by combined palpation through the vagina and the abdominal wall, may be recognized as a process of the intestine.

**Etiology.**—Herniæ within the vagina may be due to descent of the bladder, rectum, or intestine. The first two are usually the result of parturition, and are especially common with those who have borne many children, who work hard, and bear heavy burdens. In the third form the intestine descends through the top of the vagina after the uterus has been removed, or an incision has been made in the anterior or posterior fornix. In rare cases a prolapsed intestine in Douglas's pouch has been forced through the vaginal fornix by a sudden impulse or by continued straining independently of any surgical procedure.

**Treatment.**—Relief to these conditions involves surgical measures. Those which were mentioned in the description of prolapse of the vagina may be used for the cure of rectocele and vesicocele, while for the hernia at the top of the vagina the patient may be placed in the left lateral posture with the hips elevated. The tumor can then be reduced, if possible, with the finger. A sufficiently large portion of the prolapsed vaginal mucous membrane is then dissected away; the sac of the hernia opened, cleared by careful manipulation of its contents, if it has any, and cut away; the edges of the peritoneal stump brought to the edges of the vaginal wound; and the tissues all closed with interrupted sutures, worm-gut being preferred for this purpose. Instead of this method, one may follow Thomas's recommendation: open the abdomen, draw back the prolapsed omentum or intestine

out of the sac, draw back and excise the sac, and close the wound with silk or catgut. After this the prolapsed portion of the vagina may be excised and the wound sutured.

**CYSTS.**—*Symptoms and Etiology.*—Cysts of the vagina are not of frequent occurrence. They may occur singly or there may be several on one or both vaginal walls. They may be retention cysts containing lymph or mucus, to which blood may have been added by rupture of contiguous vessels. Purulent

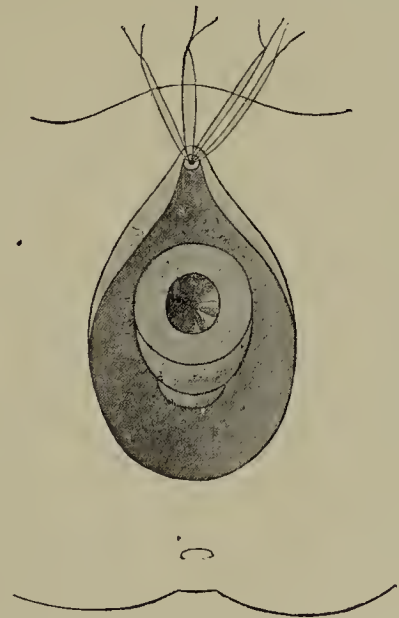


Fig. 3 shows the appearance of the reformed bladder from the vagina. The guiding threads are shown issuing from the meatus. (*Stannmore Bishop.*)

degeneration may be a subsequent stage. An abscess forming a cystic tumor of the vagina may also result from a hæmatoma, or from a tumor within the pelvis (pelvic abscess, cyst of the broad ligament, etc.) which communicates with the vagina by means of a sinus or fistula.

Histological examinations have shown that cysts of the vagina may be classified as follows: (a) inclusion cysts; (b) cysts of embryonic-tissue origin; (c) cysts of glandular origin.

(a) Inclusion cysts, due to the epithelium being included within the raw surface, follow a traumatic lesion of the

vagina. This is the most probable origin of cysts found on the posterior wall of the vagina, though a cyst of such origin may occur in any portion of the vagina.

(b) Cysts of embryonic-tissue origin are most probably due to either the foetal remains of a portion of the lining epithelium of a Wolffian duct or to a dilatation of the duct itself, the most likely position for cysts of such an origin being upon either lateral wall.

(c) Cysts of glandular origin are due to the dilatation of one or more glands of the vagina. If von Preuschen's theory of glands be accepted, then the dilatation may be considered to have taken place in the branching portion of the glands. J. E. Stokes (Johns Hopkins Hosp. Reports, vol. vii, '98).

These cysts seldom attain any great size, and they are not usually painful except when connected with severe lesions of the pelvic organs.

The size of cysts of the vagina varies from that of a pea to a small orange. Those cysts which are larger are generally found to have arisen without the vaginal tissue. The most common locations are the posterior wall, about the median line; the lateral wall, upon either side; in the sulcus formed by the junction of the posterior and lateral walls; and the anterior wall, in the suburethral area. The appearance of the cyst *in situ* is of importance, as it not only aids in showing the etiology of the cyst,—cysts without the vaginal tissue being more apt to be conical in shape,—but aids in making the differential diagnosis. The vaginal mucosa may be smooth or thrown into ridges. The smaller cysts generally resemble a white grape, but may be of a dark-brown color, the larger ones being generally of a dark, opaque color. The walls may be thin or markedly thickened.

The smaller cysts of the vagina seldom, if ever, give rise to any symptoms. The larger cysts may produce painful and frequent urination, painful defecation, dysmenorrhœa, dragging pains in the back, difficult locomotion, or dyspareunia. If decidedly large they may obstruct labor. A diagnosis is generally

made without difficulty. The possibility of connection with the bladder or rectum or the presence of a hernia should always be borne in mind. J. E. Stokes (Johns Hopkins Hosp. Reports, vol. vii, '98).

The positive diagnosis of cysts can always be corroborated without the least danger (if the ordinary necessary aseptic precautions are taken) by the use of the hypodermic syringe. With cysts simulating cystocele (if the hypodermic is used for differential diagnosis), due care must be observed to avoid aspirating the bladder by passing directly through the cyst into the cavity. This may be avoided by introducing a sound into the bladder to determine the relative thickness of the suspected tissue. When the tumor is on the posterior wall, the index finger is introduced per rectum and the thumb *per vaginam*; and all the structures between can be easily distinguished. Herman L. Collyer (Amer. Medico-Surg. Bull., Apr. 25, '99).

*Treatment.*—The uncomplicated cysts may be ligated at their base and excised, or if too deep seated for ligation, they may be exposed by incision in the vagina and dissected out, the wound being then carefully closed. If connected with a tumor of the pelvis, of course this must be removed as a preliminary to their removal.

*HÆMATOMATA.*—Hæmatomata of the vagina are rare. It has been said that they sometimes result from a thrombus, but a thrombus in a vaginal vessel followed by a rupture and blood-tumor, while conceivable perhaps as an accident of labor, is at least improbable. As a result of pressure or bruising or violence with instruments during labor it is quite possible, but I do not remember to have seen such an accident nor the record of such.

Accidents of other kinds are accountable for this condition, such as violent coitus, masturbation with wooden or metallic substances, falls astride a fence or a chair, or thrust with any hard



substance or thing in a violent manner. It is possible also as an accompaniment of purpura hæmorrhagica. No age is exempt from such a tumor. It may be little more than an ecchymosis or slightly elevated effusion, or it may occupy a large portion of the vaginal tube. The hæmorrhage which causes such a tumor is usually self-limited, the pressure of the surrounding tissues being sufficient to check it.

*Treatment.*—There is little to be done in the way of treatment; the fluid contents of the tumor are usually absorbed if they are not disturbed. Should purulent degeneration take place, the tumor would be converted into an abscess, and would require to be treated as abscesses in other locations are treated. Rest in bed will favor absorption and may prevent degenerative changes.

**NON-CYSTIC GROWTHS.**—Benign neoplasms of this class are most frequently fibroids or outgrowths from the mucous membrane. Lipomata have been reported, but they must be exceedingly rare. Fibroids may be either sessile or pedunculated. They are always sessile in their early history. They may be projected into the vagina from the uterus or they may originate within the vagina. They are seldom larger than a walnut or a small egg, and are not painful. They may be pure connective-tissue growths or they may contain muscle-elements. Little is known as to the causation of such growths.

The mucous-membrane growths are always pedunculated; they may be single or multiple, are always painless, but may give rise to hæmorrhage and a mucoid or muco-purulent discharge; they are seldom larger than a pea. The treatment consists in ligation and exsection of the polypi; incision and enucleation of the sessile tumors.

Fungous growths of the vagina have been described, but must be exceedingly rare. Garrigues ("Diseases of Women," p. 349, '97) describes two forms of these growths which usually occur among pregnant women. They are known as *Leptothrix vaginalis* and *Oidium albicans*. Their principal symptom is itching, this being especially the case with *Oidium albicans*. The vaginal mucous membrane with this disease is red and inflamed, and studded with small, whitish growths similar to those which are seen in the mouths of children afflicted with the same fungus. The distinguishing characteristics of the two fungous growths are to be determined, of course, with the microscope.

*Treatment.*—For treatment the nitrate-of-silver solution (10 per cent.) or a 10- or 15-per-cent. solution of sulphate of copper or of acetate of lead may be swabbed freely over the vaginal mucous membrane, daily until the latter has regained its normal condition and appearance.

#### **Foreign Bodies.**

Of course, these are not really tumors, but they may become fixed in the vagina and be more or less surrounded by new tissue and so become essentially tumors. They may consist of hair-pins, pieces of glass, pessaries long neglected and overlooked, and a great variety of other substances. They are often introduced for the purpose of masturbation, and sometimes from mere perversity on the part of the patient. They may excite intense inflammation. In some cases they form a focus from which malignant disease develops. They may cause intense pain, and their removal may be very difficult. In some cases they may be removed with forceps; in others they must be removed by dissection.

There are three hundred and sixty-four cases on record in which deleterious re-

sults have followed retention of vaginal pessaries. In many cases the instruments have grown into the vagina or have become incrustated or produced perforation and have been removed with difficulty. The use of Gigli's wire saw is suggested in the removal of such retained pessaries. An aneurism needle threaded with silk is carried about the pessary, the saw is tied to the silk, by means of which it is then drawn around the pessary. Max Madlener (Centralb. f. Gynäk., Oct. 1, '98).

### **Malignant Growths.**

Of malignant growths of the vagina sarcoma is very rare. It consists in an infiltration of the vaginal wall, is very painful, and its presence can only be determined by excision of a portion and its examination by the microscope.

Carcinoma is also, for the most part, an infiltration process. It may be an extension from carcinoma of the uterus; in fact, the disease rarely originates in the vagina. The tissues involved may be hard or soft, and they bleed readily and profusely. This condition is sometimes caused by the irritation of a pessary or other foreign body in the vagina.

Five personal cases of primary cancer of the vagina. Only 0.43 per cent. of all cancers in women are of vaginal origin. Some foreign authorities make the percentage as low as 0.38 or as high as 1.6. The earliest age at the onset of the disease was 17, for in Johannovsky's patient, aged 9, the growth was evidently sarcomatous, and in Guersant's, a child only 3 years of age, the nature of the tumor remains doubtful. Cancer of the vagina has commenced to develop after 70. In 76 cases where the age was accurately given the onset of the disease occurred thus: Third decade (20 to 30), 12 cases; fourth, 14 cases; fifth, 12 cases; sixth, 22 cases; seventh, 14 cases; and eighth, 2 cases. Thus most cases arise long after the menopause, and hence it may be inferred that the origin of the disease has no direct connection with the incidents of reproductive life. R. Williams (Med. Rec., Nov. 30, 1901).

**Treatment.**—The treatment for both these diseases consists in early and extensive removal with knife, scissors, or actual cautery. In some cases the diseased tissue can be removed only by scraping with the sharp curette. Recurrence is almost certain to take place unless the entire growth is removed in its incipency.

Pennington, of Chicago, has devised a shield of metal which is clasped around the x-ray bulb; this shield has a cylindrical prolongation which can be used as a speculum or to which a speculum can be attached, and through which the rays are concentrated on growths in the rectum and vagina. The writer reports three cases of cancer of the vagina in which he has employed the x-ray treatment, in all of which there has been some varying degree of success. He concludes, however, that at the present time, in certain cases of cancer of the cervix, nothing short of complete removal should be attempted. In the later stages of the same condition where the vaginal vault is involved and also the body of the uterus, it is highly improbable that more than temporary relief can be given the patient by surgical means, it would certainly seem that the x-ray treatment should be resorted to. Thomas P. Scully (Annals of Gynecology and Pediatrics, May, 1903).

### **Absence and Defects of Structure.**

The vagina may be congenitally absent or it may be entirely occluded as the result of disease or surgical operation. Congenital absence is rare; it signifies arrest in the development of Müller's ducts during embryonic life from causes of which we know very little. It may co-exist with perfect development of all the other genital organs.

Inflammatory disease of the vagina (erysipelas, diphtheria, sequelæ of severe labor, etc.) may cause extensive sloughing and exfoliation of the mucous membrane, followed by complete adhesive union of the anterior and posterior walls.



Acquired atresia of the vagina may be caused by difficult, especially tedious, labor, falling astride, injuries from foreign bodies, burns and scalds, syphilis, vaginal diphtheria, variola, and possibly pneumonia, yellow fever, and typhus. Kummer (Corres. f. Schweizer Aerzte, Jan. 1, 15, '99).

Complete closure by surgical procedure has been recommended for certain diseased conditions, *e.g.*, for extensive and inoperable vesico-vaginal fistula,—the menstrual fluid being discharged through the bladder. There are no troublesome symptoms with congenital absence of the vagina if there is also absence of the ovaries. There are no symptoms before puberty in any case, as a rule, nor after the menopause. Trouble, difficulty, is usually due to the accumulation of menstrual blood within the uterus, a tumor being formed which may be of considerable size. I have seen it extend nearly to the umbilicus in a girl of 16.

The pain of such a tumor is more or less constant, but becomes worse with each accession of blood as the menses recur.

**Treatment.**—The treatment consists in opening the uterus, evacuating its contents and preventing their reaccumulation. In a case of absence of the vagina under my observation I was obliged to evacuate the contents of the uterus through the rectum, then, with a sound in the uterus (through the opening in the rectum) as a guide the perineum was in part torn and in part cut through until the uterus was reached. The home of the patient was in a distant town, and the false opening was unfortunately allowed to heal. The menstrual blood reaccumulated and the tumor recurred, I therefore felt justified in removing the ovaries subsequently producing, by gradual cutting and dilating, a vaginal orifice

about two and a half inches long, which has persisted and is apparently lined with mucous membrane. The health of the patient is now (five years since the operation) very good, and she has been able to earn a living in a useful occupation for a long time.

The transplanting of flaps, obtained from prolapse operations on otherwise healthy women, to the granulating sides of the artificial vagina in cases of complete atresia suggested. First an opening is made between the labia in the position to be occupied by the new vagina, and then with a finger or a blunt instrument an opening is dissected up to the external os or through it if the cervical canal has been occluded. The cavity thus formed is tamponed with iodoform gauze, and kept distended in this way until the whole surface is covered with healthy granulations. Then transplanting may be done in one sitting or in several. Great care is necessary in the preparation of the flaps; they must be quite thin, of uniform thickness, and removed with great care not to injure the vitality of their tissue. The flaps, as soon as dissected off, are laid with their raw surfaces together in a warm sterile vessel until they may be used. After the flap or flaps have been fitted to the granulating surface they are intended to cover, they are kept in place with a tampon for ten days, during which time the patient must be at absolute rest in bed. A. Mackenrodt (Centralb. f. Gynäk., No. 21, '96).

In congenital absence of the vagina operation to establish an artificial vagina should be performed, even if no uterus is present and no retained menstrual fluids require evacuation, for the sake of the mental impression upon the patient, as well as when she can be rendered normal by the operation. For, when this is not performed, coitus will be performed through the urethra. Latouche (Archives Prov. de Chir., No. 4, '97).

In congenital absence of the vagina, a crescentic incision is made across the interlabial space, with its concavity upward, thus getting a little shelf of mucous membrane below the urethra to

divert the escaping urine. By blunt dissection a free cellular space is created between the bladder and the rectum, to the depth of five inches. This is temporarily packed with sterile gauze. Thiersch skin-grafts are cut from the thigh sufficient to cover well an ample plug made thus: A thin French rubber pouch is sterilized by boiling and is stuffed with long strips of iodoform-gauze to its full capacity. Upon this the skin-grafts are spread, with their wet sides outward and their edges freely overlapping. Numerous small punctures are made in the rubber after stuffing, so that the gauze-contents will receive any discharge lurking about. A piece of rubber tubing the size of one's little finger, wrapped loosely about with iodoform-gauze, is now inserted into the rectum, with the view of permitting free exit of gas during the subsequent days of enforced constipation. Finally the graft-covered form is carefully passed into the new vaginal space, the walls of which are held apart by three deep retractors, which on removal allow the fresh surfaces to come into closest contact with the wet surface of the grafts. To prevent the plug from being in the least displaced, two silk-worm-gut stitches are passed across the vulva, transfixing the gauze-packed tampon, and are tied over iodoform-plugs at either side. For four weeks the patient is kept recumbent, the vagina being packed with gauze liberally smeared with lanolin, and afterward, when the new skin is quite tough, being dilated daily with large vaginal plugs and bougies, which are worn for a few hours at a time. Inevitable stenosis by cicatricial contraction reduces the original canal to smaller proportions; hence, it should be made more than ample in the original design. Robert Abbe (*Med. Record*, Dec. 10, '98).

Defects in the vagina may also be congenital or acquired. The former may consist in a small or imperfectly developed tube and in one or more septa dividing the vagina into loculi. These septa may extend the entire length of the vagina, they may be attached to the portio vaginalis uteri at or near the os,

or they may avoid the uterus entirely. Sometimes they extend across the vagina like a secondary hymen.

Acquired defects of the vagina may consist in narrowing or atresia after unsuccessful operations, after inflammatory diseases with sloughing or necrosis, after severe labor, after cauterization from heat, acids, etc., as the result of injuries or the infiltration of a malignant disease process, and as the consequence of atrophy which comes with age or the premature appearance of the menopause.

Atresia, which comes with old age or the premature menopause, is usually irremediable. When it is due to other causes it may sometimes be overcome by the judicious use of dilating instruments and the cutting of bands and strictures.

#### Diseases of the Vulva.

No age or condition of life is free from disease of this structure. The relatively greater prominence of the vulva in childhood compared with mature life renders it the more exposed to disease and injury; hence the not infrequent instances of suffering, as to the vulva, in little children from accident, want of cleanliness, parasites, etc.

#### Vulvitis.

This general term includes a variety of inflammatory conditions with more or fewer elements and symptoms. It may signify merely an inflammatory condition of the skin, an inflammation of the subcutaneous connective tissue, an inflammation of the vulvo-vaginal glands and the tissue surrounding them, or an inflammation of the mucous membrane contiguous to the vagina.

The varieties of vulvitis may be classified as (1) traumatic and (2) infectious.

**Symptoms.**—Symptoms which attend traumatic vulvitis are those which attend similar injuries in other parts. If the skin is not broken or bruised, ecchy-



mosis will mark the injured surface, and at a later stage, if suppuration has occurred, fluctuation will be apparent. Pain is almost always a prominent symptom, arising from pressure if an effusion of blood underneath the skin renders the tissues tense, or attributable to direct injury to the nerve-endings if the actual or potential cautery has been used, or due to bruising of the tissues and subsequent inflammatory reaction in connection with lacerated and contused wounds.

Hæmorrhage may be external or internal, that which proceeds from the venous plexuses, with which the vulva is richly supplied, being sometimes very profuse. Swelling is usually a conspicuous symptom, the swollen tissue being soft and compressible when the bleeding has taken place within the loose tissues of the vulva, or hard and firm when due to inflammatory exudate; it gradually subsides as absorption takes place or the fluid is released by incision.

Suppuration occurs not infrequently, for the tissues are vascular; cellular tissue is prone to suppurate, while the secretions of the vulvo-vaginal glands, if retained, during the inflammatory process readily undergo degenerative changes. Uncleanliness and want of care in the treatment of traumatisms of the vulva will predispose to suppuration here as elsewhere.

There is no discharge from the mucous surface of the vulva during the acute stage of this condition, the glandular secretions being checked. As the acute inflammatory symptoms subside, however, the mucous membrane becomes moist again. The constitutional impression from this condition varies with the individual; robust women and children show little febrile reaction, while those who have poorer resisting power may

suffer much. If the wound becomes infected, enlargement of the inguinal glands and general disturbance may follow.

A traumatic inflammation of this character if treated antiseptically may show acute symptoms three or four days, the exudate, if there is any, disappearing in two or three weeks. Should the treatment be defective, the duration of the disease may be indefinitely prolonged.

**Etiology.**—The question of infection enters so largely into the consideration of all inflammatory conditions that it is often argued that the non-infectious conditions are few and not easily differentiated, or even that they do not exist. While it is almost impossible to say that infectious elements are wanting in certain cases of vulvitis, we can at least point to traumatic factors as dominating and originating. Traumatism in this, as in every other part of the body, may be accidental or intentional. It may consist in any kind of a wound or bruise and be followed by more or less intense symptoms of inflammation. Among the accidents which cause vulvitis may be mentioned falls astride a chair or fence, thrusts from sticks or implements of wood or metal, applications of various forms of caustic material (mineral acids, chloride of zinc, etc.), heat from boiling water, from the flames of burning clothes, etc., the horns of angry animals, bites and stings of insects or other animals, etc.

The *intentional* traumatisms which produce vulvitis are the wounds which are inflicted by the surgeon with knife, the actual or potential cautery, also the wounds which are due to violence and brutality, kicks, rapes, violent coitus, self-inflicted injuries, and many others.

**Pathology.**—The pathology of traumatic inflammations of the vulva is sel-

dom obscure. If the lesion involves the skin alone it will be very difficult to cleanse it and keep it clean, for it is often the seat of parasites; it is often bathed with offensive and irritating secretions, and it is frequently soiled by menstrual blood, urine, and even fæces. It is not easy to eliminate the conditions which result in infection from such a tissue.

The subcutaneous tissue—rich in fat, cellular tissue, and vessels—shows the same tendency to inflammatory reaction, which is ordinarily shown by cellular tissue or highly-nourished erectile tissue. Wounds in this location, therefore, not infrequently suppurate, and suppuration and sloughing are not without danger, for there may be profuse hæmorrhage from large venous plexuses, or general infection through opened veins and lymphatics.

The large glands on either side of the vulva which secrete the lubricating fluid for the vulvar mucous membrane may bear no unimportant share in traumatic vulvitis. They may undergo direct injury and the duct be closed in the inflammatory condition which follows, or the inflammation of the surrounding tissues may be communicated to them. The secreting function of the glands may be destroyed, scar-tissue taking the place of the normal glandular tissue. In other cases the obstruction of the duct may simply lead to the formation of a cyst, which will be filled with the retained glandular secretion.

**Complications.**—Phlebitis and lymphangitis are among the rarer complications of this condition, the possibility of their occurrence should constantly incite to the adoption of the utmost care and cleanliness in any plan of treatment which may be followed.

**Treatment.**—The treatment should be such as modern asepsis and antisepsis in-

spire in the treatment of all traumatic inflammations, the basis being cleanliness. If pain is severe, a vulvar pad, secured by a T-bandage and kept moist with the lead-and-opium lotion (U. S. P.), may be used. Irrigation two or three times daily with hot saline solution (100° to 110° F.) or with boric acid (10 per cent.), carbolic acid (2 per cent.). Thiersch's solution, or peroxide of hydrogen will favor the healing process. Extensive wounds must be cleansed, trimmed, and sutured with the same care which would be used if they occurred in other parts of the body, burns may be dressed with vaselin, carron-oil, or other approved substances, the serum from large vesicles being carefully withdrawn, and pain relieved by hypodermics of morphine ( $\frac{1}{8}$  grain) and atropine sulphate ( $\frac{1}{120}$  grain). Abscesses and retention cysts must be evacuated, care being taken to avoid opening the venous plexuses on either side of the vulva. If there should be elevation of temperature (102° or higher), quinine in 10-grain doses may be given at night with especial reference to its sustaining and tonic effects. The bowels must be kept open, fluid extract of cascara, 1 drachm at night, or any other approved cathartic being used. The diet must be composed mainly of fluids. Rest in bed is desirable, and if these hygienic precautions are observed the active course of the disease may not exceed a week.

It is desirable to continue the vulvar dressings and irrigation and abstain from coitus or fatiguing work as long as any pain, swelling, or induration persist.

#### **Infectious Vulvitis.**

By far the greater number of cases of inflammation of the vulva are of infectious origin.

This statement seems reasonable enough when we realize that the skin



and mucous membrane are always the abodes of organisms which only await favoring conditions to become noxious. The vulva is also the most vulnerable location for infection by the organisms peculiar to venereal disease, and the number of cases of such disease is beyond computation. Filthy habits, uncleanliness, and carelessness are also responsible for many cases. The following varieties are suggested:—

1. Venereal { Gonorrhœal.  
Chancroidal.  
Syphilitic.
2. Parasitic.
3. Eczematous.
4. Tuberculous.
5. Diphtheritic.

Few forms of disease to which women are susceptible are more common than venereal vulvitis. I have chosen the subdivisions of this disease which are accepted in the nomenclature of venereal disease in men, though it is certainly doubtful, in many cases, whether the so-called chancroids exist independently of the gonorrhœal bacterium (gonococcus).

**Symptoms.**—In each of the forms of venereal vulvitis it must be remembered that we have, as a rule, a section or fragment of a more extensive disease. The symptoms may be limited to the vulva during the initial period, but they are not likely to remain thus limited.

Gonorrhœa in its relation to the vulva presents acute inflammatory symptoms, the tissues being hot, dry, and swollen from three to seven days, after which they are soiled with a more or less purulent secretion. There may be no eruption upon the skin or there may be a crop of warty growths sometimes few in number, sometimes abundant, not limited to any particular spot or area, but often more abundant near the pos-

terior commissure than elsewhere. They are painless, and vary in size from a pin's head to that of a small cherry. Other developments are the soft chancroidal sores sometimes limited to the fourchette or the mucous membrane of the vulva, and sometimes covering the whole vulva with a disgusting accumulation of discharging ulcers. Like the venereal warts, these are seldom painful except as the ulcerated surfaces on opposite sides are rubbed against each other as the patient moves about.

A very common accompaniment of gonorrhœal vulvitis is the inflammation of the vulvo-vaginal glands. The infective process extends from the duct to the structure of the gland, the duct being occluded in some instances, while in others it is the avenue for the escape of exuberant secretion. Suppurative inflammation, as already observed, is not unusual.

In syphilitic vulvitis the initial lesion may be on any portion of the skin or mucous membrane. It is not always easy to find it, for it (the Hunterian chancre) may be very small and without well-marked distinguishing characteristics. It is often hidden within the navicular fossa or on the inner side of the vulva, and may be overlooked without a very careful search. Acute inflammatory symptoms apart from those which proceed directly in connection with the sore or sores are not frequent, and may not appear in the vulva at all. The neighboring inguinal glands may be enlarged and painful, but they are not thus affected invariably. The erythematous eruption of syphilis is often seen upon the skin of the vulva, while the ulcerative lesions of the late periods of the disease are relatively rare.

**Etiology.**—The cause of this disease is, of course, the specific poison of one

or the other infectious condition alluded to in the table. Chancroids and gonorrhœa are very frequently associated, as already observed, if, in fact, they are not identical. Syphilis and gonorrhœa are less frequently associated, but the combination is not very rare. This disease results almost solely from coitus. I have heard the usual stories of communication by means of towels and water-closet seats, but such a method of inoculation is apt to be questionable. The disease may occur at any age. I have seen it in the little child and in the toothless dame of three score and ten. The tissues of women between the ages of 20 and 30 are the most susceptible to its influence. In very young children the poisonous agent is often conveyed by the hand of the infected mother when the child is washed or dressed, or it may come from contact with an infected father or mother while in bed at night.

**Pathology.**—The pathology of gonorrhœal and syphilitic vulvitis is that of gonorrhœa and syphilis, in which an intensely infectious agent is communicated directly to the skin or mucous membrane. It is not necessary that the tissue be abraded to insure inoculation, though it occurs more readily, of course, through a broken than through an unbroken surface. The active agent of infection in gonorrhœa is the gonococcus of Neisser: a diplococcus, or biscuit-shaped microbe, of considerable vitality and good powers of reproduction and found upon the exterior as well as the interior of epithelial cells.

The essential bacterium of syphilis has not yet been isolated.

**Treatment.**—The treatment of these diseases consists, first of all, in cleanliness, frequent ablutions or douchings with hot water (100° to 110° F.) being desirable. For local applications noth-

ing will surpass the frequent and liberal use of a 10- to 20-per-cent. solution of nitrate of silver, the entire affected surface being freely covered with it. Quite recently protargol has been introduced as a substitute for the silver salt, but it is doubtful whether anything will entirely supersede a remedy of such tried efficacy. For internal treatment a ferruginous tonic may be given or a combination of quinine, strychnine, and gentian. The well-known elixir of iron, quinine, and strychnine is very efficient, and the proportions of the different drugs may be varied to suit individual requirements. If syphilis is present, the mercurial treatment will be indicated. I know of nothing better than the protiodide in  $\frac{1}{8}$ -grain pills, given three or four times daily until the limit of tolerance has been reached. Local lesions must be kept clean and treated daily with the nitrate-of-silver solution.

#### Parasitic Vulvitis.

**Symptoms and Etiology.**—Various degrees of inflammatory disturbance are excited by parasites which infest the vulva. In children, worms (*lumbri*c*i*, *ascarides*) whose habitat is the rectum, sometimes migrate to the vulva and cause much uneasiness and more or less inflammation.

*Pediculi pubis* are very common among those who have attained puberty, the hair-follicles upon the labia and mons veneris being attacked. Intense itching, with consequent scratching and rubbing, results. The inflammatory reaction is very decided, the vulva being sometimes converted into a mass of suppurating sores.

**Treatment.**—The treatment involves cleanliness and great gentleness of manipulation. Irrigation with a 2-per-cent. solution of creolin should be practiced twice daily. The hair of the vulva



should all be carefully clipped away, and the entire surface freely anointed with mercurial ointment (*unguentum hydrargyri*). After the parasites have been destroyed the inflamed surface may be kept constantly covered with the officinal zinc ointment until complete healing has occurred.

### Eczematous Vulvitis.

**Symptoms and Etiology.**—This condition occurs more frequently among those who have passed the menopause than at earlier periods; indeed, I have seldom seen it in those who have not reached the change of life. It is usually associated with a vaginitis in which there is an acrid discharge soiling the vulva and producing irritation especially during cold weather and at night when the patient is in bed. The itching in such cases becomes almost intolerable, this being the well-known *pruritus vulvæ*. Scratching and rubbing cause great disturbance in the skin, which may become dry and hard, like parchment, or may exude a serum which excoriates the skin and adds to the discomfort. It is not improbable that poisonous germs from dirty finger-nails are frequently communicated in this disease, thus complicating the condition. The suffering may be so great as to cause hysteria or even insanity.

**Treatment.**—The treatment consists, first of all, in cleanliness and abstinence from scratching. The entire inflamed surface should be covered with a paste made from subnitrate of bismuth rubbed up with glycerin (sufficient glycerin being combined with sufficient bismuth to make a rather thick paste, which will adhere readily to the skin, but will not run), this being applied freely and frequently, and the vagina plugged with cotton-wool moistened with the same mixture. This treatment, in addition to

vaginal douches sufficiently astringent (tannic acid, alum or hydrastis combined with hot water), and cathartics at night (compound cathartic pills, 1 or 2; or fluid extract of cascara, 1 drachm) will usually bring the disease under control and must be continued as long as any symptoms remain. Of course, much will depend upon the care and skill with which the local treatment is administered and the persistence with which it is continued.

### Tuberculous Vulvitis.

**Symptoms.**—This form of disease—manifested by tubercular sores, not the so-called tubercular eruption of syphilis, but that in which there is a true tubercular process developed by tubercle bacilli—is of occasional, but not frequent, occurrence. It is characterized by a painless ulcerative eruption of the labia, especially the labia majora, which shows the usual features of tubercular processes: sloughing, want of tendency to heal readily, and scarring and contraction after healing. It is probably identical with lupus of the vulva, which has been described by many writers, but not always with the same pathological idea in view.

**Treatment.**—The treatment should be a general tonic one, with the administration of iron, codliver-oil, strychnine, and an abundance of wholesome food; locally cleanliness is to be scrupulously observed and the use of astringent ointments. The following formula is suggested:—

R Creasoti,  $\frac{1}{2}$  drachm.  
Ichthyol.,  $\frac{1}{2}$  drachm.  
Ung. zinci ox., 1 ounce.

M. Sig.: Apply freely.

### Diphtheritic Vulvitis.

There is in this form of vulvitis a true inflammatory process of infectious origin

identical with that which is characterized by a deposit of exudative material or false membrane upon mucous surfaces in general (*e.g.*, upon the pharynx, intestine, or uterus). It sometimes occurs in little children as an accompaniment of croup and diphtheria, or with the eruptive fevers. It may occur in women as an accompaniment of diphtheria, though this is rare in adults, or it may occur as one of the phenomena in puerperal septicæmia; in other words, it is a phenomenon which rarely occurs alone. It is of grave importance, for it signifies profound toxæmia and a gloomy prognosis.

The general treatment which is advised includes inhalation of oxygen, internal use of chlorine-water and general supporting measures. The local treatment requires the greatest caution and delicacy of manipulation, and usually involves also the treatment of a similar condition in the vagina and uterus. Cleanliness must always be most scrupulously observed, no portion of the diphtheritic membrane being allowed to soil the tissues contiguous to the vulva. In children and virgins it is desirable to avoid entering the vulva, but a pad of absorbent cotton may be kept constantly in contact with the vulva moistened with chlorine-water, or a 10-per-cent. solution of nitrate of silver, or a 5-per-cent. solution of hydrochloric or carbolic acid. For puerperal women and multiparæ in general vaginal douches of creolin (2 per cent.) may be used, with great gentleness, twice daily, while in the intervals the vulvar pad moistened with the 10-per-cent. solution of nitrate of silver, or 2-per-cent. solution of protargol should be constantly applied.

#### **Atrophy of the Vulva.**

This condition is the usual accompaniment of age, the hair of the labia becom-

ing sparse and straggling, the labia majora flabby or still somewhat prominent if the supply of fat is abundant, the labia minora small and insignificant, while the vulvo-vaginal glands lose their activity and participate in the general shriveling and abolition of function. This condition may also come prematurely as the result of general failure of nutrition or in consequence of the removal of the ovaries and the resulting premature menopause. It does not by any means occur as a customary result, however, of the early removal of the ovaries.

A rare form of atrophy is that which causes the well-nigh complete disappearance of the labia minora. This was described by Breisky (*Centralb. f. Gynäk.*, p. 358, '85), and by him was called kraurosis. Very few cases of this form of atrophy have been recorded.

#### **Hypertrophy of the Vulva.**

This condition is a relatively common one. It may involve the labia majora alone, the labia minora alone, or may include both. In syphilis and chancroidal disease we frequently have this condition, the labia majora being more frequently implicated. The degree of enlargement varies; it may be moderate, or the vulva may be four or five times its normal size. The skin is hard and board-like to the feel, a dense infiltration taking place in the skin and cellular tissue. It is painless, without febrile movement, and is usually self-limited; but it may persist for months, yielding as the disease yields to constitutional measures. When the tension in the skin is considerable a few linear, but shallow, incisions will bring relief by depleting the tissues. The use of a few leeches will accomplish the same result. The extensive enlargement of the labia known as elephantiasis arabum is not seen in this country. Its



nature is the same as that which has been referred to, but it may be due to an infectious medium other than that of venereal disease.

Hypertrophy of the labia minora is also a very common condition. Among the negroes of Africa it is said that the enlargement is sometimes enormous, the labia hanging down in great folds and masses. A very common cause for this condition is masturbation, the nymphæ being very sensitive and constant friction and traction producing elongation and enlargement. I have never observed that such enlargements caused any particular annoyance, save in one instance, this occurring in a prostitute about 20 years of age, who was syphilitic and an opium-smoker. The tumors were as large as a man's fist and were a decided impediment to coitus. Some of those who saw the case believed the tumors were of syphilitic origin, others that they were simply inflammatory. They were removed with the cautery-knife, but after a few months the vagina was filled with a recurrent growth. The result is not known.

#### Varicocele.

**Symptoms and Etiology.**—This condition occurs not infrequently as an accompaniment of pregnancy. It is, in all cases, an evidence of interference with the venous circulation. The venous supply of the vulva is extensive; hence any condition which causes an increase of pressure in the pelvis may derange the venous circulation. Fibroid tumors of the uterus, tumors of the ovaries and tubes, pelvic abscess, pelvic peritonitis and cellulitis, and subinvolution of the uterus may all cause interference with the venous circulation and result in enlargement in the veins of the vulva. In the later months of pregnancy the enlargement of these veins is sometimes

enormous, and the danger of rupture is constantly imminent. Occasionally rupture does occur, either just before or during labor and hæmorrhage, phlebitis, or thrombosis may confront one, with grave possibilities.

**Treatment.**—The treatment may consist of rest in bed and the use of a pressure bandage upon the enlarged vessels. A pad of absorbent cotton moistened with an astringent solution (tannic acid, alum, or fluid extract of hydrastis) may be worn until the cause of the pressure can be removed; when this has been done the varicocele usually disappears.

#### Tumors of the Vulva.

Mention has already been made of tumors of the vulvo-vaginal glands (retention cysts, abscesses, etc.; venereal tumors, hypertrophy of the labia, and inflammatory enlargement in general).

The vulva may also be the seat of furuncles, erysipelatous inflammation, hernia, hæmatoma; and enlargement from various benign and malignant growths. Furuncles should be incised as early as possible, even before suppuration occurs, the incision being repeated should tension become troublesome. Antisepsis and cleanliness need hardly be mentioned as indispensable. For erysipelas rest in bed and the constant use of the ordinary lead-and-opium lotion are indicated. The application of pure carbolic acid at the border of the swelling has been highly recommended as a check to the progress of the disease. The destruction of tissue which is likely to result from the use of this powerful substance must not be forgotten.

Hernial tumor of the vulva may result from prolapse of an ovary or from descent of the intestine through the inguinal or femoral canal into the labium majus. The differentiation of the causes of hernia is not always possible, and

when operating for this condition it is well to remember the desirability of returning a healthy ovary to the pelvic cavity. The prolonged ovarian ligament may be shortened by looping it upon itself to prevent recurrence of the prolapse. The Bassini operation offers good prospect of radical cure for hernia in women. Hydrocele of the round ligament will, in some cases, simulate intestinal hernia, and must be distinguished from it in the plan of treatment. The contents of such a tumor are, of course, to be evacuated and a portion of the tumor-wall removed to prevent possible recurrence of the condition. Hæmatoma of the vulva may occur apart from that which occurs with varicocele. It consists in a swelling of one or both labia majora, and is almost invariably the result of traumatism. Rest, pressure, and the application of soothing lotions form the principal means of treatment. Should abscess occur, it must be treated by suitable surgical measures.

Other benign tumors of the vulva which also are of rare occurrence are fibroma of the round ligament, dermoid, and lipoma. These are to be treated surgically as would be the case should they occur in other parts of the body.

Among 420 primary neoplasms of the external genitals in women, Williams found only 17 fibromas, or only about 1 in 600 of all the new growths in women he tabulated. The fibrous and fibromatous tumors that are seen in this region may have their origin in two main sources: (1) the subcutaneous connective tissue, and (2) the connective tissue and terminal muscular fibres of the round ligament, and possibly in muscular fibres in the skin, while, as curiosities, may be mentioned tumors arising in [a] the pelvic fascia and periosteum of the bony pelvis, [b] the recto-vaginal septum, and [c] the uterus. Malcolm Storer (Boston Med. and Surg. Jour., Dec. 15, '98).

Malignant disease of the vulva may be either carcinoma or sarcoma, the former being the more frequent. Their clinical differentiation is difficult and sometimes impossible. They present an indurated mass, which is usually very painful and may have numerous ulcerating and discharging areas. The mass develops rapidly, and in a short time the inguinal glands become enlarged and painful. The diagnosis is not difficult, syphilis being excluded.

Epithelioma of the vulva is liable to be confounded: (1) with simple vegetations; (2) with lupus of the vulva; and (3) with syphilitic affections; but the first, the simple vegetations, secrete a virulent liquid unlike the ichor of cancer, they readily yield to an energetic caustic which prevents their reproduction, and they have no hardened base, being remarkable for their softness. In the case of lupus, the vulva is red and presents scattered fungous ulcerations which are without any indurated base; while the syphilitic chancre is more limited and has a little circle of characteristic induration. Wilmer Krusen (Phila. Med. Jour., Sept. 2, '99).

**Treatment.**—The tumor should be removed as thoroughly and as promptly as possible, and my preference is for the cautery-knife for such operations. The hæmorrhage may be very profuse, but it can usually be checked by firm pressure. The tumor is likely to return quickly and should be removed as often as the conditions will warrant it.

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### VAGINO-PERINEAL INJURIES.

**Surgery of the Perineum.**—Rupture of the perineum may be described as a splitting of the perineal body, which latter directly or indirectly supports the bladder, rectum, uterus, and the intestines. Various degrees of laceration are described which may be classed under the



heads: "Complete" and "Partial Rupture." These include the following degrees of destruction:—

Superficial rupture of the fourchette and perineum, not involving the sphincters.

Rupture to the sphincter ani.

Rupture through the sphincter ani.

Rupture through the sphincter ani and involving the recto-vaginal septum.

Not infrequently subcutaneous rupture of the muscular tissue and fasciæ of the perineum takes place, leaving the skin and mucous membrane intact. These latter are called concealed ruptures, and are followed, as in the other forms, by relaxation of the pelvic floor and loss of perineal support.

**Symptoms.**—The symptoms of perineal rupture are at first a feeling of weakness and dragging down of the pelvic viscera, and later the prolapse of the various organs resulting, when the rupture is partial, in subinvolution of the vagina; prolapse of the vagina, with cystocele or rectocele; and prolapse of the uterus. When the rupture is complete, to these may be added incontinence of fæces and intestinal gases and prolapse of the rectum. As an exception, the patient may suffer but little even when the two passages are laid into one; but generally the patient's condition is a sad one. Fæcal matter and gases pass without control, and the pelvic organs tend so strongly to descend that exercise, muscular efforts, or tenesmus produce a sense of weariness, pain throughout the pelvis, and traction upon the broad ligaments.

**Diagnosis.**—The diagnosis of this condition is made by inspection.

**Etiology.**—The most common cause of laceration of the perineum is parturition through rapid delivery with forceps, unusually large head, or one persisting in the occipito-posterior position; less fre-

quently through some accidental injury, as the passage of large tumors, a fall upon a sharp object, etc.

**Pathology.**—In partial perineal ruptures there is the exposure of a more or less extensive raw surface, richly supplied with blood- and lymph- vessels, and in close proximity to the intrapelvic and inguinal chains of lymphatic glands. This raw surface is, as a rule, indisposed to heal by first intention and over its surface for two or three weeks there is an uninterrupted flow of a fœtid, semi-putrid, irritating fluid consisting of disintegrated muscular tissue, decaying and flaking decidua, disorganized blood, and muco-pus. In complete perineal rupture the presence of fæcal matter and intestinal gases are added. Rupture of the perineum in the puerperal state may lead to septicæmia, anterior or posterior displacement or prolapse of the uterus, cystocele, rectocele, uterine engorgement and hyperplasia, subinvolution of uterus and vagina, loss of power of uterine ligaments, development of a tendency to abortion, an impairment of sexual gratification to the male, and neuralgia affecting the site of the rupture.

**Prognosis.**—When the rupture is incomplete and of slight extent and only a small portion of the perineal body is involved, symptoms may be lacking and no evil follow. In first labors laceration of this kind and extent is the rule, and not the exception, and interference is not necessary. The first and second degrees of laceration mentioned above are often without evil consequences, and may be unknown to patient or physician unless through careful inspection; this is not the rule, but the exception. The third degree is always a grave accident. The fourth degree is the most serious form. The more serious the laceration, the less chance there is of spontaneous recovery

and the more probable the complications and evil results before mentioned. Proper repair of the rupture is always productive of great gain to the patient.

**Treatment.**—Every perineal laceration should be closed by suture immediately after the expulsion of the placenta whenever the rent seems large enough to demand repair, for the purpose of securing primary union, if possible. Rare exceptions to this rule might be made in cases of extreme exhaustion or where there is no chance of immediate union on account of the bruised condition of the parts. The worst cases of laceration usually follow instrumental or manual delivery, and may be discovered while the patient is yet profoundly anæsthetized. The circumstances are propitious for an immediate operation, which, if successful, will save the patient much suffering, while failure will not make her condition worse. The obstetrical bag should always contain needles and sutures for this operation. T. Gaillard Thomas notes three factors which may tend to defeat the success of immediate operation: hasty operation; entrance of the lochial discharge into the wound; failure to close the upper portion of the perineal body, leaving a pouch for the accumulation of putrefying materials and leaving the anterior vaginal wall and bladder without support.

If failure of primary operation ensue, a second operation should not be done before the results of parturition have disappeared,—say, not less than two months.

**IMMEDIATE OPERATION.**—The old method of immediate operation was to introduce the first suture at the lower angle of the rent, and the last one at the posterior commissure, passing them as deeply as possible to include the whole of the torn surfaces. T. G. Thomas of late years has advised another plan. He takes a strong curved needle, at least three

inches in length, threads it with strong sublimated silk, and passes it from a point corresponding to the upper margin of the rent on one labium downward and backward above the upper angle of the laceration in the posterior vaginal wall and out again at a spot corresponding to the point of entrance on the opposite labium, keeping the suture carefully concealed. The wound having been thoroughly cleansed by irrigation or sponging with a 1 to 5000 sublimate solution, this single suture is securely tied; in this way the floor of the vagina is at once closed, and the remaining perineal wound shut off from contamination by blood oozing from the uterus. Usually, now not more than two other comparatively superficial stitches have to be passed, care being taken that the deep portions of the wound are included and approximated when the sutures are tied. It is claimed for this operation that it is very easy of performance, requires but a few minutes, and is well borne even by very much exhausted patients. The sutures are usually removed between the fourth and seventh days, when they will have begun to cut, and are no longer of any use, whether union has taken place or not.

**DELAYED OPERATION.**—When primary operation has been omitted or has failed, a plastic one is necessary for restoration of the perineal body. These operations should not be undertaken until from six to twelve months after the original injury. During this interval the general health of the patient should be looked after, and tonics administered if necessary. For a week before the operation the bowels should be kept open by mild cathartics, so that all scybala may be removed. In cases of complete rupture the bowels should receive like attention for two weeks, a compound cathartic or compound rhubarb pill, or a saline laxative



being given every twelve hours to secure free atonic evacuation; hypercatharsis should be avoided. During the same time the vagina should be thoroughly syringed, night and morning, with warm borosalicylic or hydronaphthol douches. Immediately before the beginning of the operation the parts should be shaved and well scrubbed.

The instruments required will consist of a sharp bistoury, long-handled scissors curved on the flat, two pairs of mouse-toothed forceps and pair of dissecting forceps, a dozen hæmostatic forceps, a needle-forceps, two or more large curved needles, preferably Hagedorn's, as many small curved needles, and a pair of suitable retractors for holding back the labia. Sterilized silk is to be preferred for sutures, a coarse thread for the deep sutures, and a finer one for the superficial ones. Catgut is best for ligatures, and in some cases for sutures. The patient, dressed for bed, should be placed upon a table, under a good light, in the position for lithotomy, with the pelvis elevated on a hard pillow, and etherized. Four assistants will be found useful, although three may be sufficient. One of these should administer the anæsthetic, one should hold each knee, and the fourth should hand the instruments.

The operative procedures will vary according to the preference of the operator and according as the laceration is partial or complete. The concealed variety should be transformed into the incomplete or partial by transfixion with the bistoury and incision as the initial step of the operation.

**FLAP-SPLITTING OPERATION.**—This operation was introduced by Lawson Tait and indorsed by Saenger, Martin, Mundé, and others. In this operation no tissue is removed, the result being achieved by simply splitting transversely

and perpendicularly the surfaces which are later united. This operation is useful alike in partial and in complete rupture.

The patient, after the usual preliminary preparation, being placed in the lithotomy position, the recto-vaginal septum is split from side to side, beginning in the middle line, by means of a pair of sharp-pointed scissors. If the laceration be an incomplete one, the incision is prolonged up on either side to the upper border of the perineal cicatrix, the depth of the wound upward being not more than from a quarter to a half inch. The upper, or vaginal, flap is then drawn upward by means of a tenaculum or forceps; the lower, or rectal, flap downward in the same manner; and the sutures are then passed, being carefully concealed throughout, from the left side of the patient to the right, beginning at the point nearest to the anus, using a straight or very slightly curved needle. Thomas and Mundé advise that the sutures be introduced just outside the edge of the wound, emerging at the same spot on the opposite side. Tait recommends passing them just within the edge of the wound, which does not allow the edges of the skin to be brought into close apposition as by the method of Thomas and Mundé. After all the sutures have been introduced, they are tied, and the puckering of the posterior vaginal commissure is corrected by short interrupted catgut sutures, so as to insure complete closure of the wound.

In complete laceration, on either side of the transverse incision which splits the recto-vaginal septum a downward and backward incision is carried, which goes just beyond the edges of the separated sphincter-ani muscles. A more marked dimpling on each side of the anus shows plainly the location of the retracted ends of the sphincter ani when the laceration

is complete. The points must be denuded and the sutures so placed as to bring and hold them in apposition until union has occurred. The flaps are held apart, upward and downward as already described, and the first suture, beginning from behind, is inserted just outside and below the edges of the torn sphincter ani and brought out exactly at the same spot on the opposite side. The stitches are then introduced and tied as in the incomplete operation. Although the operation may be performed within ten minutes, it will be found necessary to introduce a certain number of superficial catgut sutures into the perineum or along the vagino-perineal commissure, if we wish to secure perfect cutaneous union. In complete lacerations there is more certainty of securing a perfect restoration of function of the sphincter-ani muscle, and in preventing the formation of a recto-vaginal fistula than with other methods.

In the after-treatment especial care should be taken to protect the wound from contamination by the urine. The urine should be drawn by a catheter or the patient may be allowed to turn over upon her face and urinate in that position, after which the parts should be thoroughly douched with a boro-salicylic solution. The sutures may be removed after ten days, but such removal should be delayed if they are not causing irritation or have not ceased to hold the parts. The recumbent posture should be maintained for three weeks, and four weeks should elapse before the patient is allowed upon her feet.

EMMET'S OPERATION.—In this operation the crest of the rectocele is first determined as well as the extent of the lateral tears. The posterior surface of the vagina is then "denuded from the edge of the sphincter-ani muscle up each labium to the remains of the carunculæ,

and across on the posterior wall of the vagina to the extent of the rectocele," so that the denuded surface, by its median portion and lateral prolongations into the sulci corresponding to the tears, resembles a trefoil. The first suture is introduced near the anus, followed by others introduced at higher levels, the first four being usually carefully concealed in the tissues. The fifth suture perforates only the labium on each side and loops up a part of the median raw surface as it passes over it. The last suture perforates the labium on each side and loops up a portion of the mucous membrane just above the denuded surface.

GALABIUS OPERATION.—In this operation the extent of surface to be denuded is generally that of the cicatrix resulting from the laceration, but "it is well to go a little beyond the limits of this in all directions, especially up the median line of the vagina and toward the lower halves of the labia majora, both in order to secure, if possible, a perineal body somewhat larger and deeper than the original one, and to allow some margin in case the surfaces do not unite completely up to the edges." The mucous membrane of the vagina is first slit vertically in the middle line from a little beyond the upper edges of the cicatrix down to the edge of the sphincter. From the anal end of this median incision semicircular incisions are made outwardly on each side not extending farther than the lower extremity of the nymphæ. This blocks out two triangular flaps on each side, which are to be dissected from the anal apex toward the base, which is transverse. All of these flaps when once mapped out are to be removed, excepting a transverse border at the base. They are then united by suture (silk-worm gut). In bringing out the sutures in the centre, Galabin advises that they be brought out "for spaces



alternately short and long," so that the surfaces may be more easily brought into contact at all levels without undue tension.

The performance of secondary operations for ruptured perineum is advised during the puerperal period; that is, from the second to the twentieth day after labor. The operation is undertaken in those cases where immediate suturing after labor has not been done, or where, if done, has not been successful. The patient's vagina is carefully washed out with corrosive-sublimate solution and a tampon of sublimate gauze inserted to take up the discharge. The tampon is removed just before the operation, the vagina again syringed out, and a fresh tampon inserted, which remains *in situ* for twenty-four hours. After this the tampon is unnecessary, and careful vaginal douching is sufficient. The operation consists in first marking out the extent of the raw surface, and then removing the granulation or cicatricial tissue with a sharp spoon within that limit. The sutures are then inserted in the usual way, and the raw surfaces brought together. The sutures are removed on the seventh day. Kholmogoroff (Vratch, No. 19, '98).

In complete tear of the perineum the following plan is personally used: The denudation is made so that there is no rectal wound. An incision is carried across the septum at least a centimetre above the margin between the junction of the rectal and vaginal mucous membranes. This incision extends across the whole septum and above and beyond the sphincter-ends. Taking this as the baseline, the operation on the vulvar and vaginal portion of the rent is then made in the usual manner, as in the case of repair of an ordinary relaxed vaginal outlet. Having completed this denudation, the operator turns his attention to the rectal tear. He inserts his left index finger into the bowel and draws the septum forward, and then carefully dissects the strip of undenuded tissue described above so as to free it and turn it down as an apron. At the sides of this flap the ends of the sphincter-muscle are caught

up and liberated. The purpose of the flap is to turn down an apron or fold of tissue, which, when the sutures are all in place, projects out of the anal orifice and points in a direction away from the impact of the fæcal masses.

When the denudation is complete and the apron turned down, the presence of dead spaces in the septum is avoided by the following plan: Three or four catgut sutures are applied in the form of a figure-of-eight. They are inserted above, and each suture grasps the fibres of the internal sphincter-muscle well to one side of the median-line sutures, is then carried to the opposite side, and then past the tissue of the septum well above the internal sphincter; it then returns to the first side and includes the corresponding area of tissue, and is finally brought out through the internal sphincter at a point corresponding with point of entrance. This entire suture is buried in the septum. Then the sutures (silk-worm gut) which approximate the triangles are introduced, and then those of the perineal surface. The final step is the union of the edges of the apron, which now lie more or less crumpled together and projecting at the anus; by leaving these sutures long and making slight traction this entire line can be drawn well outside and fixed on the buttocks by a strap of adhesive plaster. Howard Kelly (Amer. Jour. of Obstet., Aug., '99).

The reason a dead space is often left in closure of lacerated sphincter is that the operator does not denude far enough beyond the fistula. As the surfaces to be sutured represent two arcs of a circle, it is necessary to suture so that they radiate like the sticks of a fan. No matter how the sutures are inserted, if the bowels are not moved daily by a saline cathartic, a certain percentage will necessarily fail. T. A. Emmet (Amer. Jour. of Obstet., Aug., '99).

**VALERIAN.**—Valerian is the rhizome and rootlet of *Valeriana officinalis* (nat. ord., *Valerianaceæ*): a native of Europe, but cultivated in America. The principal constituent of valerian is a volatile oil which, by oxidation, yields valerianic

acid. Valerianic acid may be made artificially by the oxidation of amylic alcohol, and it is from this acid that the official valerianates of ammonia, iron, quinine, and zinc are found; but it does not quite correspond with the natural acid in its physiological effects. The ammoniated tincture is a valuable preparation, owing to the stimulating and carminative effects of the ammonia. The valerianates are seldom used except in the combination known as the "three valerianates" of iron, quinine, and zinc. An elixir of valerianate of ammonia is an excellent preparation when well made; it should contain 2 grains of the salt to the fluidrachm and may be given in quantities up to a tablespoonful.

**Preparations and Doses.** — Valeriana (U. S. P.), 10 to 30 grains.

Extractum valerianæ fluidum (U. S. P.), 4 to 8 drachms.

Tinctura valerianæ, U. S. P. (20 per cent.), 1 to 2 drachms.

Tinctura valerianæ ammoniata, U. S. P. (powdered root, 20 parts; aromatic spirit of ammonia, sufficient to make 100 parts), 1 to 2 drachms.

**Physiological Action.** — Valerian is a very feeble depressant to the nervous system, tending to produce rest. It reduces irritability and reflex contractions, and is a sedative to the spinal cord. In large doses it produces a feeling of warmth in the stomach, and sometimes nausea, vomiting, and colicky pains. The pulse is generally slightly quickened, and a sense of exhilaration is induced, accompanied, however, by formication in the hands and feet (H. C. Wood). Very large doses cause a feeling of heaviness, and even of pain, in the head.

**Therapeutics.** — Valerian is valuable for the relief of the milder forms of functional disturbance arising from a weak and overexcitable or an exhausted

nervous system. It is, therefore, given with advantage in nervousness and hysteria, but is less useful in *mania a potu* and in the delirium of adynamic fevers, in which latter cases it is generally conjoined with the bromides or with more powerful remedies.

## VALVULAR DISEASES OF THE HEART AND ENDOCARDITIS.

### Endocarditis.

**Definition.**—Inflammation of the membrane lining the cavities of the heart. The process may be acute or chronic. The acute form is variously described as "simple," "benign," or "verrucose," and "ulcerative," "septic," or "malignant," according to the mildness or severity of the disease; but between these two forms there is in reality no dividing-line. The disease attacks mainly the valves of the heart.

### Acute Endocarditis.

**Symptoms.**—The onset of acute endocarditis is insidious. There may be no symptoms which call especial attention to the organ affected. There may be a slight rise of temperature, and some quickening, and possibly some irregularity, of the pulse. In the benign form there may be no evidence of the disease until two or three months after it has run its course, when impairment of the valves is detected. In some cases there is præcordial pain, or, if the patient is a child, there may be epigastric distress, with vomiting. The pulse is of low tension, and the patient may be restless and anxious, and may prefer a somewhat recumbent to a horizontal position. Examination of the heart will disclose in most cases a murmur, usually of a blowing character, and usually systolic in time. It may accompany or replace the normal sound. Even in the malignant form the symptoms may be masked by



those of the original disease. In the severer cases sometimes there is a true chill or a succession of chills; and the fever may be either typhoidal or intermittent or remittent in its character. The patient gives evidence of great prostration. The pulse is rapid and irregular; the body bathed in profuse perspiration; the spleen enlarged and tender. There may be a rose-colored eruption upon the body; more often petechiæ are seen. The number of white corpuscles in the blood is greatly increased.

In some cases, even the worst, careful and repeated examination by competent observers may detect no cardiac murmur whatever.

The simple form may give rise to embolism in different parts of the body, and may also be complicated by pleurisy or pneumonia. The malignant form is still more apt to give rise to emboli than is the simple form, and also frequently distributes infection. In fact, scarcely any tissue is exempt from these dangers. Thus, there may be embolism of the femoral or external iliac arteries, or of the capillaries of the skin. There may be infarctions in the spleen, causing a swelling and tenderness of that organ; in the kidneys, giving rise to renal hæmorrhage; in the brain, with resulting paralysis or softening; in the intestines, with bloody stools. The retina, conjunctiva, gums, parotid gland, and stomach may be affected. In some cases there is acute jaundice, with symptoms simulating acute yellow atrophy of the liver; and, as just stated, these lesions are not merely mechanical, but infectious, and apt to give rise to suppuration.

When acute endocarditis is due to recurrence of inflammation in a valve previously fibrotic, abscesses are unusual.

The duration of the disease in the milder cases is usually from two to six

weeks, perhaps in most instances about four weeks. The malignant cases may reach a fatal termination in one or two days; or again, they may be prolonged for several months, or a year, and then prove fatal. Some cases of simple endocarditis are not suspected during their course nor betrayed by sequelæ; thus, minute vegetations may be found, post-mortem, upon the valves of patients who die of consumption or of carcinoma, which have been of no importance whatever. The great harm that simple endocarditis does the patient is not immediate, but consists in laying a foundation for ultimate changes in the valves, which impair the functional integrity of the heart.

**Diagnosis.**—The first question to settle with regard to diagnosis is whether any endocarditis exists at all, and, secondly, whether the form is simple or malignant. There may be no objective cardiac signs distinctive of the disease. Usually, however, there is a systolic apical murmur, and the heart is enlarged, with a more widely diffused impulse than normal, and an excited—though feeble—action.

It should be borne in mind that many of the diseases with which acute endocarditis is etiologically associated give rise to functional cardiac murmurs; so that the mere discovery of an abnormal sound over the heart does not establish the diagnosis.

TYPHOID FEVER is more gradual in its onset and has a small number of white blood-corpuscles contrasted with the leucocytosis of endocarditis and an infrequent pulse. Moreover, the Widal reaction is distinctive of typhoid, as would also be the discovery of typhoid bacilli in the stools. Typhoid may give rise to infarctions, and to inflammation of the parotid, but not often.

ACUTE TUBERCULOSIS has its hectic fever, rapid wasting, possible pulmonary signs, sometimes tubercle bacilli, and, as a rule, no objective cardiac symptoms.

MALARIAL FEVER may be recognized by the discovery of the characteristic organisms in the blood.

SEPTICÆMIA AND PYÆMIA have symptoms identical with those seen in certain forms of malignant endocarditis, which disease has, indeed, been called an arterial pyæmia. In some acute cases there is possibility of confusion with typhus fever, cerebro-spinal meningitis, abscess of the liver, and hæmorrhagic small-pox.

IN SEVERE INFECTIOUS DISEASES, unless there be signs of obstruction of a valve, it may be impossible to determine whether there be endocarditis or a myocarditis due to toxins, rendering the wall flabby and the mitral valve relatively incompetent.

**Etiology.** — Endocarditis is an infectious disease, and almost always secondary to some other. It is most frequently an expression of rheumatism. It may follow tonsillitis, pleurisy, chorea, measles, small-pox, and any acute infectious disease, particularly scarlet fever. Pneumonia, influenza, erysipelas, gonorrhœa, pericarditis and meningitis may present this complication; as may also, in rare instances, typhoid fever, tuberculosis, and diphtheria. Osteomyelitis, puerperal fever (as well as other vaginal or uterine affections), empyema, bronchiectasis, external wounds, and any form of septicæmia may occasion endocarditis. Cancer, gout, diabetes, and Bright's disease may give rise to it.

Almost invariably some form of bacteria is found in the lesions; but there does not seem to be any bacterium peculiar to the disease. In both the simple and malignant forms the pyogenic micro-organisms are those most often encount-

ered; namely, streptococci, staphylococci, pneumococci, and gonococci.

Before birth the right side of the heart is almost exclusively affected; after birth, the left. Early adult life furnishes a majority of the cases; and, according to the latest statistics, men are somewhat more liable to the disease than women.

Pneumonic endocarditis is not very infrequent. A malignant endocarditis arising in connection with pneumonia may be caused by (1) the pneumococcus and (2) the streptococcus and staphylococcus. These different forms of the disease are differentiated by the course, temperature-curve, and complications. The course of a true pneumonic endocarditis is much shorter than that of a streptococcic endocarditis. When malignant endocarditis is due to the pneumococcus, the fever is usually continuous, whereas in the other forms it is intermittent. Infarcts and metastatic abscesses are very rare in pneumonic endocarditis, but are usually found in the endocarditis produced by the pyogenic microbes. Kerschensteiner (*Münch. med. Woch.*, Aug. 3, '97).

Thirty-six cases of endocarditis were studied from the bacteriological point of view by microscopical and culture-methods. In thirty-four cases the result was positive, in two only it was negative. The histological examination in both these cases established the fact that they were not a true endocarditis, but an atrophic thrombosis. From an analysis of the cases it is concluded that (1) the diplococcus and the streptococcus are the most constant agents in endocarditis; (2) that these are able to produce, whether alone or associated with other micro-organisms, the ulcerated as well as the verrucose form; (3) that the diplococcus more frequently causes aortic, and the streptococcus mitral, endocarditis. Desse (*Lo Sperim.*, anno lii, fasc. 1, '98).

Acute endocarditis may occur in the course of phthisis. It is most frequent in acute miliary tuberculosis, but a true diagnosis of its tubercular character is impossible during the life of the patient. Pericarditis and endocarditis are usually



fatal complications in phthisis, and their occurrence becomes the more rapidly fatal the more advanced the patient appears to be in the lung affection. Von Ruck (*Jour. of Tuber.*, April, 1900).

A case of acute simple endocarditis has never been observed in the New York Foundling Hospital in the past twenty-seven years, the service covering the admission of 27,000 infants, with autopsy in between 2000 to 3000; heart-murmurs have been frequently noted, but they have been transitory or unexplained at the autopsy; one case of malignant endocarditis has been seen as a part of a septicæmia. Northrup (*Jacobi Festschrift*; *Phila. Med. Jour.*, May 26, 1900).

Number of cases in which the disease followed septic infection of the ordinary nature that had nothing to do with rheumatism. One of these is remarkable for the fact that, although the patient was under observation for a number of months, and at the autopsy numerous vegetations were found upon the aortic valve, no murmur had been heard at any time during the course of the disease. We cannot discriminate between staphylococic and streptococic infection by the type of temperature. The diagnosis of the condition is to be made from the presence of symptoms of sepsis and a murmur in the heart, and confirmed by the existence of a palpable tumor of the spleen. Lenhartz (*Münchener med. Woch.*, July 16, 1901).

Malignant endocarditis is a disease of the bacterial origin; it differs from single acute endocarditis in the extent of endocardial inflammation and tissue necrosis; in the fact that the right heart is more often attacked; in the more frequent embolic processes which are septic in character. Micro-organisms are found in the blood during life, in the emboli, and on the heart valves after death. There is nothing in the clinical appearance distinctive of any particular variety of germ causing it.

Primary cases are rare, though they do exist; most cases, however, accompany rheumatism, septicæmia, the acute infectious diseases, or are engrafted upon an old endocarditis. Almost all

are fatal; the ones due to severe infection in a few days; the septic ones in a few weeks. The first variety have a leukocytosis of 15,000 or over, the latter usually below that number, some being very slight. Embolical hæmorrhages are of frequent occurrence, and may be fatal in their results. The urine usually shows evidence of nephritis; it may contain blood and pus from hæmorrhage or infarct.

Treatment is usually unavailing, excepting the serum therapy, which is of uncertain value. Infants and young children seem to be almost exempt from the disease. M. H. Sicard (*American Journal Medical Sciences*, Nov., 1904).

**Pathology.**—It has already been said that clinically there is no dividing-line between the simple and malignant forms of endocarditis. This is also true pathologically. The simplest lesions consist in minute warty vegetations, varying from one to four millimetres in diameter, seated upon the valves. These consist of masses of fibrin, leucocytes, blood-platelets, and micro-organisms. Sometimes the vegetations are so large as to obstruct the valvular orifice. Even in the simple form (*endocarditis verrucosa*) there is more or less ulceration of the valvular endocardium. In the malignant form (*endocarditis ulcerosa vel diphtheritica*) necrosis is more extensive. The valve may be so thinned as to give way under the pressure of the blood, thus producing a valvular aneurism, or actual perforation of the valve. A portion of the valve may be destroyed and broken off, or some of the chordæ tendineæ may be ruptured.

The vegetations are situated mainly on that surface of the valve which is opposed to the blood-current. Thus, the lower surface of the aortic valves and the upper surface of the mitral valves are chiefly affected.

Exceptionally the heart-wall suffers, sometimes leading to cardiac aneurism

or perforation of the ventricular septum or perforation into the pericardium.

The associated lesions peculiar to endocarditis are mainly caused by emboli; and yet it is a surprising fact that sometimes, even when the valvular lesions are decidedly ulcerative, no evidence of embolism may be found post-mortem.

Embolism affects the spleen and kidneys most frequently, and also many other organs, as above enumerated. If the right side of the heart is affected, there may be multiple pulmonary abscesses.

Autopsies of 23 cases of endocarditis. Five patients showed acute verrucose endocarditis with superficial bacteria; 7 were subacute verrucose endocarditis with organized vegetations in which bacteria were imbedded; 5 were old ulcerative endocarditis with deformity and calcification of the valve leaflets; and 6 were fresh endocarditis in tuberculous, cancerous, or old people. Every verrucose endocarditis is mycotic in origin. J. Bartel (Wiener klin. Wochen., Oct. 10, 1901).

In addition to the pyæmic and the typhoid types of infective endocarditis, there is a third and important one, the cardiac type. In this type the duration may be comparatively long—months rather than weeks. It is often difficult to decide whether the cardiac symptoms are entirely due to old fibrosis of the valves, or whether there are fungating masses on the valves as well. Probably the additional symptoms most suggestive of the latter are some pyrexia, multiple emboli, splenic enlargement, and progressive anæmia.

There is no sharp line of demarcation between simple and infective endocarditis; so that whereas some cases of endocarditis are slight, and recovery soon, and others are very severe, and die soon, a third group are on the border-line between the two, and continue doubtful as to their prognosis for weeks and months; and may even recover when they seemed certainly to have fungating endocarditis.

Pyrexia in the ordinary sense is not necessarily present although the patient is suffering from fungating endocarditis; in which connection it is most important to remember that the natural body temperature in cases of old valvular heart-disease may be as low as 96.6° F., so that what may be normal temperature in normal subjects may be actual pyrexia in them. Herbert French (Practitioner, Dec., 1904).

**Prognosis.**—First, it is possible that very slightly developed cases of simple acute endocarditis recover without any real damage. The great danger from the non-ulcerative form, besides embolism, is the setting up of a chronic fibroid deterioration of the valve, ultimately destroying its efficiency.

The malignant forms are almost invariably fatal. Cases in which the acute process has been kindled upon the remains of a former valvular inflammation are somewhat more hopeful.

**Treatment.**—First, prophylaxis: Rheumatic patients should be kept as quiet as possible. The salicylates do not seem to lessen the liability of such patients to endocarditis. It may be that the administration of alkalies in sufficient amounts to keep the urine neutral is of some advantage.

In the various children's diseases the only way in which we can protect the patients from cardiac complications is by insuring bodily quiet and good ventilation and avoiding exposure to cold.

In gonorrhœa such internal antiseptics as salol and urotropin are advisable. Antistreptococcic serum may be injected in any case where we dread that pyogenic organisms may be attacking the heart.

Second, when the disease has actually developed, an ice-bag wrapped in flannel may be kept over the heart if not disagreeable or depressing to the patient. Or, instead of this, a thin layer of cotton-wool may be applied. Violent counter-



irritants are not indicated. If the heart's action is excited, aconite or bromide of sodium may be administered. Still more efficient, and in case of cardiac distress indispensable, is morphine, used in carefully-regulated amounts. Most important of all is absolute bodily quiet, and this should be maintained for at least four to six weeks. In case the heart begins to fail, recourse must be had to digitalis, strophanthus, alcohol, ammonia, and other cardiac stimulants, but in many cases their use will prove unavailing. Sometimes when the attack has been long continued, arsenic has been found beneficial.

In repeated instances antistreptococcic serum has proved efficacious, even when the disease has been well developed.

An ice-bag over the heart calms the patient and relieves the dyspnoea and oppression. If the pain is very great, injections of morphine may be given. Cold baths are useful. The diet should consist entirely of milk, and the patient should receive small quantities of alcohol and quinine or salicylic acid. The alcohol should be given in the form of Bordeaux wine or champagne, and coffee may be used as a stimulant. Alcohol is particularly hurtful in cases in which there is cardiac distress. The inhalation of oxygen in considerable quantities, at least one hundred quarts a day, gives good results. Quinine is given in the dose of from 8 to 15 grains a day. Should the heart become feeble, it may be well to give small doses of the tincture of digitalis. Plicque (*Revue Internat. de Méd. et de Chir.*, Apr. 10, '96).

In the treatment of septic endocarditis the strength of the patient must be increased by all means possible. Milk, eggs, port-wine, brandy, and strong coffee should be given.

A water-bed is beneficial. The affected joints should be protected, kept at rest, and an ice-bag placed upon them; internally, sodium salicylate in solution should be administered. An ice-bag should be kept constantly upon the heart; in case of high fever, another

upon the head. If a febrifuge is required, 7 grains of quinine in powder or wafers are recommended. If severe diarrhoea supervenes, 15 grains of bismuth subnitrate, or tannic acid, 3 grains, with  $\frac{1}{10}$  grain of opium, may be given every hour or two. Ludwig Herzog (*Deut. med. Woch.*, No. 45, '98).

Case of ulcerative endocarditis in a girl, aged 22 years, in which 210 cubic centimetres of antistreptococcic serum were injected, the dose varying from 10 to 20 cubic centimetres, 15 cubic centimetres being given every other day during the last twelve days. The patient improved steadily and recovered. J. M. Clarke (*Lancet*, July 21, 1900).

Digitalis and strophanthus should not be given, or, if at all, with great caution. They are dangerous remedies in these cases. In intense arrhythmia strophanthus may, however, be tried cautiously, but it is apt to be unreliable, and, like digitalis, it should only be given in emergencies, and for a very short time. The milder remedies should be tried first. T. E. Satterthwaite (*N. Y. Med. Times*, May, 1901).

### Chronic Endocarditis.

Chronic endocarditis may develop in a previously healthy valve. It is more often a sequel to acute endocarditis. The symptoms are those of valvular disease of the heart, and will be discussed later.

Its etiology is, first, hereditary tendency to arterial sclerosis. Secondly, certain predisposing causes, namely: gout, alcohol, syphilis, and habitual muscular overexertion. Exceptionally the wall of the heart itself is affected by the process, in which case it presents scar-like patches, which are often associated with myocarditis.

Valves changed by chronic endocarditis are more or less opaque, thickened, and cicatricial or calcified. They may be contracted, deformed, curled up, and adherent by their edges to one another. The chordæ tendineæ may be involved in the process and thereby deformed, or fastened one to another, or greatly con-

tracted so that the distorted valve is apposed to the muscular papillæ. The apices of the papillæ themselves may be more or less fibrotic. Fœtal endocarditis is usually of this chronic form.

### Valvular Lesions.

Whether the abnormal state of the affected valve causes incompetence or obstruction, there results in either case an unnatural demand upon the muscular power of the heart. Thus, stenosis leads to an increased effort during systole of that cavity which is obliged to force blood through the narrow outlet, and a leaking valve permits blood to flow backward into the cavity which it has just left, and thus obliges it to do part of its work a second time. In either case, the affected cavity is made to contain a larger amount of blood than normal.

In case either auriculo-ventricular valve leaks, the corresponding ventricle receives, during diastole, a larger amount of blood than normal from the overdistended auricle.

The heart possesses reserve forces, and, while the immediate effect of a valvular lesion is dilatation of the chamber affected, the secondary result is hypertrophy of the muscular walls, and a more or less complete fulfillment of the new demands. Unfortunately, however, there is for several reasons a tendency to retrogression. In the first place, the valvular endocarditis may grow worse by slow change or because of a recurrent acute inflammation. Secondly, the myocardium is apt to deteriorate so that the muscular power of the heart diminishes. Thirdly, in some forms of valvular disease, particularly aortic, the coronary arteries from which the heart derives its nourishment are apt to be involved. The period during which the heart, having hypertrophied, remains equal to the demands made upon it is called the period

of "compensation." Sudden exertion, great mental excitement, or the stress of intercurrent disease may cause a temporary "disturbance" of this compensation. Finally, extreme degrees of valvular deformity and myocardial degeneration bring about "ruptured compensation," from which there is little hope of recovery.

### Mitral Regurgitation.

**Definition.**—Insufficiency of the mitral valves, permitting blood to leak into the left auricle during systole.

**Symptoms.**—The subjective symptoms of mitral regurgitation depend upon the degree of compensation present in the individual case. Thus, if the condition is a favorable one, the patient may be unconscious of any unnatural state whatever, having no dyspnoea except on considerable physical exertion. On the other hand, if the circulation is beginning to be embarrassed, we may observe palpitation, shortness of breath on exertion or excitement, cyanosis, œdema of the dependent parts, and so on, as described in a previous volume under DILATATION OF THE HEART. On physical examination the heart is found to be enlarged mainly in its transverse diameter, the apex being pushed toward the left, and the limit of dullness extending further toward the right than in health. The cardiac impulse may be more diffuse than in health, and visible in the epigastrium as well as in the normal position. In young subjects the præcordia may be somewhat bulged. On palpation, a systolic thrill may sometimes be distinguished; this is not, by any means, the rule, however. On auscultation, we hear at the apex of the heart a murmur systolic in time and transmitted outward toward the axilla. This murmur is also audible inside the lower angle of the scapula. At the base the pulmonic second sound is accented



and often reduplicated. The pulse in well-compensated cases may be nearly normal. In later stages it is rather small, frequent, of low tension, and irregular in force and rhythm.

**Diagnosis.**—The important factors in diagnosis are, first, the systolic murmur, which is usually heard loudest at the apex and transmitted outward, and which, in some instances, may be heard over a much more extensive area; in fact, almost all over the chest. Again, the murmur may be audible merely along the left edge of the sternum. The sound is of a blowing character, sometimes musical, especially toward its termination, and it replaces the first sound of the heart to a greater or less extent.

The second factor in diagnosis is the transverse enlargement of the heart. The apex may be lowered into the sixth space, but the main change is in the width of the cardiac dullness, which may extend from the left anterior axillary line to the right nipple.

Thirdly, the pulmonic second sound, heard in the second left space or over the third left costal cartilage, is accented and perhaps reduplicated. Relative insufficiency of the mitral valve, with a normal condition of the valves, but with such dilatation of the left ventricle as to prevent the closure of the mitral orifice, may give rise to a precisely similar trio of signs.

It has been claimed that the only means of making the diagnosis of valvular incompetency as distinguished from relative insufficiency would be to find, in addition to the other signs, a pre-systolic murmur due to accompanying stenosis of the diseased valve. In many cases the history of the disease and the general appearance of the patient would be equally decisive. Functional or hæmic murmurs may be heard during systole at

the apex and transmitted outward, but they are not associated with enlargement of the heart or accentuation of the pulmonic second sound.

**Etiology.**—Deformities of the mitral valve leading to incompetency are caused by acute endocarditis, and still more frequently by chronic fibroid change. Relative incompetency of the mitral valves may be due to failing compensation in case of an aortic lesion; or to the terminal stage of idiopathic hypertrophy of the heart (meaning that condition of the myocardium which is seen after habitual excess in muscular exertion and in the use of alcohol); also to changes in the heart secondary to chronic nephritis, arteriosclerosis, and chronic adhesive pericarditis.

Among 5827 patients under personal observation and treatment at the general medical clinic of the New York Post-graduate Medical School, 503 were found to be suffering from some form of disease of the heart or great thoracic vessels. These cases may be divided into two chief classes as follows: Functional disorders, 277 cases; organic diseases, 226 cases. The organic cases were mitral regurgitation, 60 cases; mitral stenosis, 35 cases; aortic regurgitation, 7 cases; aortic stenosis, 36 cases; tricuspid regurgitation, 6 cases; pulmonary stenosis, 1 case; double aortic lesions, 19 cases; double mitral lesions, 12 cases; aortic stenosis and mitral regurgitation, 4 cases; aortic regurgitation and mitral stenosis, 2 cases; aortic regurgitation and mitral regurgitation, 2 cases; double aortic lesions and mitral stenosis, 1 case; double aortic lesions and mitral regurgitation, 4 cases; combined double aortic and double mitral lesions, 2 cases; mitral lesions of doubtful character, 4 cases; aortic lesions of doubtful character, 3 cases; simple cardiac hypertrophy without apparent valvular lesion, 10 cases; angina pectoris without valvular lesion, 3 cases; myocarditis, fatty degeneration, etc., 6 cases; thoracic aneurism, 6 cases.

Of the total number of persons under observation, 3344 were males and 2483

were females. Among the 3344 males, 149—or about 4.45 per cent. of the number—suffered from functional troubles, while 137, or 4.09 per cent., had organic heart disease. Of the 2483 females, 128, or 5.15 per cent., had functional disease, and 86, or about 3.46 per cent., had organic lesions. Among males one of three great causes could usually be assigned for functional disorders. In the order of frequency these were: (1) reflex disturbances due, as a rule, to digestive disorders; (2) the use of tobacco in excess, especially among adolescent youths; and (3) too liberal indulgence in alcoholic liquors. Among the females the causes operating to produce functional disorders of the heart were mainly those referable to digestive disturbances and to diseases of the blood: anæmia, chlorosis, etc. Only a minute proportion could be justly attributed to excessive tea-drinking. The hæmic murmurs are almost invariably systolic in time, occurring either over the aortic or pulmonary areas, or in both regions; are usually transmitted into the great arteries of the neck, where they may be classed as vascular bruits, and are, in a majority of cases, accompanied by a venous hum. The blood-murmurs are rarely audible below the third rib, and in more than a hundred consecutive cases the maximum intensity of these bruits was found over the mitral area in only two.

While mitral regurgitation is the most frequent, it is also the most hopeful of all the valvular lesions, and is also the most tractable when complications begin to appear. James K. Crook (N. Y. Med. Jour., June 19, '97).

**Pathology.**—The diseased valve presents the changes already described under the head of CHRONIC ENDOCARDITIS. The edges of the valve-segments and of the chordæ tendineæ to which they are attached are frequently more or less adherent one to another. In advanced stages the valvular orifice may be transformed into a rigid, calcified ring. The mechanical effects of mitral regurgitation are as follow:—

During systole blood escapes backward through the valve into the left auricle, which cavity, therefore, receives blood both from normal sources and from this new abnormal one. Consequently the left auricle becomes dilated, and, as a consequence of the new demands made upon it, hypertrophied, so that its walls may be three or four times the normal thickness. Moreover, the left ventricle receives with each diastole, not only its normal quantity of blood, but an abnormally great amount from the dilated and hypertrophied left auricle; so that it also becomes dilated and hypertrophied. As the valve-lesions become aggravated, or the strength of the left auricle diminishes, the flow of blood from the pulmonary veins into the left auricle becomes impeded and the whole pulmonary circuit congested, thus putting a strain upon the right ventricle. It is the hypertrophied right ventricle which is the main factor in preserving a normal flow of blood in case of mitral regurgitation. At last the right ventricle fails,—dilates; the tricuspid valve becomes relatively incompetent; the right auricle is embarrassed, and finally the systemic circulation becomes congested.

Patients with mitral regurgitation before the advent of the subjective symptoms may be seen to be slightly cyanotic, and young subjects are apt to have clubbing of the ends of the fingers. As compensation fails, the lungs become congested and œdematous and undergo brown atrophy; the liver, spleen, and kidneys present the lesions of passive congestion, the lower extremities begin to be œdematous, and finally generally dropsy and orthopnoea appear.

**Prognosis.**—Mitral regurgitation may exist for years without subjective discomfort, particularly if the patient escapes any great nervous or physical stress in



life. Moreover, when compensation is impaired, judicious treatment will repeatedly restore the patient to a state of comfort. Finally, of course, the embarrassment cannot be alleviated and death ensues; but death is apt to be gradual rather than sudden.

**Treatment.**—With regard to treatment, much which is applicable to this subject has already been detailed in the article upon DILATATION OF THE HEART, and other considerations will be discussed at the end of the section on VALVULAR DISEASES.

### Mitral Stenosis.

Mitral stenosis is a change in the mitral valves which impedes the normal flow of blood from the left auricle into the left ventricle.

**Symptoms.**—Many individuals present this lesion without being conscious of ill health. They may experience a certain amount of shortness of breath upon exertion, but do not suspect the existence of cardiac mischief. Some patients are of a tolerably fresh complexion and do not suggest the idea of cardiac difficulty, but rather of chlorosis; such patients, so far as the writer's experience goes, are rather slight and undersized. The great majority of sufferers are women. Some cases are supposed to be congenital, but this must be exceptional. As compensation fails, we have the usual train of cardiac symptoms, with the difference that pulmonary engorgement, bronchitis, passive congestion of the lungs, orthopnoea and hæmoptysis are more common with this than with other valvular lesions because of the direct way in which it impedes the pulmonary circuit.

**Diagnosis.**—As already stated, the disease may be unsuspected until a physical examination is made. Upon inspection of the chest, we may observe the apex-beat, displaced slightly to the

left. The lower part of the sternum and the apex region may be somewhat prominent in children, and an impulse may be seen with the systole in the fourth and fifth left space, due to the hypertrophied right ventricle.

Upon palpation near the apex, usually somewhat inside of it, may be felt a remarkable purring thrill, which will be found to be presystolic in time and to terminate with a distinct shock corresponding to the beginning of cardiac systole. This shock may be felt over three or four intercostal spaces to the left of the sternum. Its origin is a matter of considerable speculation, but not as yet of demonstration.

On percussion the cardiac area will be found to be increased transversely to the right of the sternum. On the left it often reaches somewhat higher than normal, but laterally not much beyond the normal limits.

On auscultation at or inside the apex is heard a presystolic murmur of a characteristic quality. It is more or less rubbing, rumbling, or churning, and terminates with a sharp valvular sound corresponding to the shock felt by the hand. Immediately following this sound, if the case is one of pure mitral obstruction, is a brief pause, and then a fainter valvular sound is heard corresponding to the second sound of the heart.

If the case is one of stenosis and regurgitation combined, the first sharp valvular sound is followed by a systolic murmur.

The character of the typical presystolic murmur of mitral stenosis is so distinctive that it would seem to the writer possible to establish a diagnosis of mitral stenosis upon this sound alone without other evidence.

At the base of the heart in the second left space is heard a sharply-accented

and usually reduplicated sound, corresponding to the closure of the pulmonary valves under tension.

In cases of failing compensation, the thrill may be difficult to feel. It may sometimes then be perceived by apposing the palm of the hand lightly to the chest-wall, when a very faint and extremely circumscribed thrill may be detected. With a dilated heart the auscultatory sounds also are indistinct. It may be impossible to recognize the existence of mitral stenosis in a patient seen then for the first time. If, however, compensation be restored wholly or in part, the murmur may reappear. The time of the murmur may be post-diastolic or middiastolic rather than strictly systolic. The pulse is small, regular, and sometimes of rather high tension. When compensation fails, it becomes weak, frequent, irregular, and intermittent.

Tricuspid stenosis may give rise to a presystolic murmur, situated to the right of the sternum; but this disease is extremely rare unless congenital, and when it does occur is apt to be secondary to chronic lesions of the left side of the heart. Persons born with tricuspid stenosis are apt to be simultaneously affected with other abnormalities which entail speedy death.

The late Austin Flint called attention to the presystolic murmur frequently heard in cases of aortic regurgitation at the apex of the heart, and ascribed it to the influence of the blood-current falling into the left ventricle through the incompetent aortic valves. This murmur is associated with the ordinary signs of aortic regurgitation and is not accompanied by the peculiar thrill felt in mitral stenosis; nor is it followed by the systolic shock above described.

**Etiology.**—Rarely the lesion may be congenital. In most instances it is the

result of valvular endocarditis due to rheumatism or chorea or some other of the children's diseases. Anæmia and chlorosis have also been thought to have some influence in promoting its occurrence.

**Pathology.**—Mitral stenosis is almost invariably associated with a greater or less degree of mitral regurgitation. By itself, mitral stenosis does not cause much enlargement of the heart. The left ventricle may be of normal size or smaller. The left auricle and right ventricle are, however, much dilated and hypertrophied. The valves may be changed to a variable extent. In the most extreme cases the auriculo-ventricular orifice is scarcely big enough to admit the head of a pin. The left auricle often contains thrombi. Sometimes the great enlargement of the left auricle causes pressure-paralysis of the left recurrent laryngeal nerve—the same lesion which is caused, more often, by thoracic aneurism.

Analysis of the cases of mitral stenosis found at autopsy at Guy's Hospital during the ten years, 1886 to 1895, inclusive. There were 4791 necropsies, in 196, or 4 per cent., of which the mitral orifice measured three and a half inches or less. The stenosed orifice exceeded two and a quarter inches (one finger) in circumference in 108 cases, and measured two and a quarter inches or less in 85. Of the 196 cases, 107 were females and 89 males. The average age of death for both males and females was the same—thirty-eight and a third years. In 32 instances tricuspid and mitral stenosis occurred together. Of these 21 were females and 11 males. The tricuspid stenosis accompanied almost exclusively the severe form of mitral disease which was present in 24 of the total 32 cases. In "a large proportion" of all the cases the aortic valves were thickened, distorted, or otherwise defective, but were seldom referred to as stenosed. Excluding the cases for 1886, there were 77 cases of severe and 96 of the slighter form of mitral stenosis for the other nine years.



Auricular hypertrophy was recorded as present in 44 of the 77 cases of severe mitral stenosis, and in 21 of the 96 slighter cases.

The left auricle was stated to have been much dilated in 14 of the 77 cases of severe stenosis, dilated in 18 others, and slightly dilated in 7. Among the 96 less severe cases it was much dilated in 8, dilated in 15, and slightly dilated in 6. Hypertrophy of the right ventricle, of more or less marked grade, was present in 41 of the 77 severe cases, and in 25 of the 96 cases of less marked stenosis. The right ventricle was dilated in 40 of the 77 severe cases and in 27 of the 96 slighter cases. The left ventricle was generally normal or small; rarely enlarged by hypertrophy or dilatation. Pericarditis had been present in nearly one-third of all the cases. The pericardium was universally adherent in 35 instances. Sudden death occurred in at least seven cases. A presystolic murmur is heard sometimes in the course of the disease in about three-fifths of all cases, and a thrill felt in about one-third or less, while a history of rheumatism may be traced in upward of 60 per cent. of all cases. Samways (*Brit. Med. Jour.*, Feb. 5, '98).

**Prognosis.**—As already stated, mitral stenosis is not incompatible with a tolerable degree of health, and may not for years call attention to itself. Even after compensation has been impaired, great improvement may be repeatedly obtained by suitable treatment. On the whole, the disease may be said to be somewhat less favorable than is mitral insufficiency. Yet, of this, as of every cardiac lesion, it should be said that the prognosis depends upon the peculiarities of the individual case, which should be considered upon its own merits.

**Treatment.**—For treatment, see the article on DILATATION OF THE HEART and also GENERAL REMARKS at the end of this section.

### **Aortic Regurgitation.**

**Definition.**—A lesion of the aortic

valves allowing a reflux of blood into the left ventricle during diastole.

A patient with free aortic regurgitation may for years lead an active life unconscious of his condition. In no other valvular disease is compensation, while it lasts, so perfect. If, however, the lesion develops abruptly, it will produce marked symptoms. For instance, when it is consequent upon the sudden rupture of a segment of the valve during violent physical exertion, or when the valve is perforated by the ulcers of malignant endocarditis, the heart may be almost or completely overwhelmed by the sudden strain put upon it, the left ventricle dilating and thus causing relative insufficiency of the mitral valve, engorgement of the lungs, and an embarrassment of the whole circulatory apparatus, from which the patient can scarcely recover.

In some instances the first shock is successfully endured, and a slow development of the reserve-power of the heart establishes compensation. This happier result was observed by the writer in the case of a Western miner in whom the aortic lesion developed over night.

**Symptoms.**—Where compensation has been perfect and is beginning to fail, the first symptoms may be cerebral, such as dizziness, flashes of light, and slight headache; there may also be faintness and palpitation on slight exertion. A patient seen by the writer had for his first symptom a sharp neuralgic pain in the lower jaw which developed while he was carrying a canoe on his back through the woods of Maine. Pain may be very prominent. It is usually præcordial, but may extend into the neck and down the arms, particularly the left arm. Angina pectoris may occur, and in no form of valvular disease is sudden death more common than in this.

Compared with mitral lesions, there is

less apt to be cyanosis, bronchitis, or anasarca; more apt to be head-symptoms and pallor. Embolism may occur, and slight febrile attacks are not uncommon, either due to recurrent endocarditis or in some instances to articular rheumatism. In this and in other valvular lesions there may be delirium toward the close of life.

It is also stated that there seems to be some connection between mental diseases and cardiac lesions even when well compensated. With regard to this the writer has had no practical experience. It is usually said that the cardiac psychoses are apt to be of a melancholy character. Savage says: "With aortic or with both aortic and mitral disease, the symptoms may be either melancholic or maniacal; but I am inclined to think that, with simple aortic disease and with hypertrophy of the left ventricle, it is at least not uncommon to meet with acute mania and exaltation of ideas."

Aortic regurgitation sometimes occasions cerebral hæmorrhage; and pericarditis sometimes complicates disease of the aortic valves whether stenosis or regurgitation.

Upon physical examination it is usually easy to recognize aortic insufficiency if it exists. Inspection shows an extensive and powerful cardiac impulse. The apex is seen to be in the sixth or seventh intercostal space in the nipple-line or outside, and the chest-wall may be prominent over the hypertrophied left ventricle. Upon palpation, the powerful action of the heart is evident, and exceptionally there may be a diastolic thrill. In this disease the heart may attain its largest dimensions.

Upon auscultation, there is heard a diastolic murmur, which may be loudest in the second intercostal space on the right, or in the third or fourth space at the left edge of the sternum. Exception-

ally it may be heard best at the left side near the xiphoid cartilage. This murmur is of low pitch, and of a blowing character, and it may replace the second sound of the heart. If not, it begins immediately upon the occurrence of that sound. No cardiac murmur is audible over so extensive an area as may be that of aortic regurgitation. It may be heard all over the chest, and in the brachial and femoral arteries. In some cases it is difficult of detection, and, when this or any valvular lesion is suspected, it may be laid down as a general rule that no examination is complete unless auscultation has been carefully practiced when the patient was in a horizontal and also in a vertical position.

Sometimes the murmur can be heard best with the naked ear applied to the uncovered chest-wall. Exceptionally the murmur may be heard only at the apex of the heart, and the murmur described by Flint, presystolic in time and heard at the apex, should be borne in mind. This has been already described in discussing the diagnosis of mitral stenosis. Flint's murmur is of a blubbery character, and heard only over a limited area at the apex. The sound heard at the base of the heart is usually rather long; when it is short and gushing there is (it is claimed) reason to infer an extensive lesion. It is stated that it is also unfavorable to find the murmur audible only in the midsternal region. Sometimes the murmur has a distinctly musical quality. This is explained as due to the perforation of a valve-segment in such a way that a thin strip of valve is left intact and made to vibrate by the regurgitating blood. Frequently there is an accompanying systolic apex-murmur, due to relative incompetency of the mitral valve, although, of course, it may be a sign of coexistent mitral disease.



Usually there is at the base a systolic murmur, and this occurs independently of aortic stenosis. One explanation of its development is that the first outflow of blood from the contracting ventricle meets the still regurgitating current falling through the incompetent valve, and thus gives rise to the murmur.

The diastolic murmur may sometimes be heard, as already stated, in the peripheral arteries. Sometimes the second sound of the heart may be heard in the carotid when not audible at the base of the heart. If so, its interpretation is favorable as implying a lesser lesion of the aortic valves. Sometimes a systolic and diastolic murmur may be heard in the femoral and other arteries (Duroziez). This is obtained by a slight pressure with the stethoscope, and is due to the outward current of blood causing a systolic, and the returning blood a diastolic, sound, at the place of artificial stenosis. This is a very important diagnostic factor when found, but it is not always present in aortic regurgitation.

The femoral artery, and also the smaller arteries, such as the dorsalis pedis and the radial, usually afford a peculiar, sharp valvular "pistol-shot" sound with each cardiac systole. This sound may exceptionally be doubled.

The pulse is characteristic. It has been called the "water-hammer" pulse, or the "Corrigan" pulse, after Corrigan, who admirably described it, or the "shuttle" pulse. It is very quick and abrupt, and extremely ill sustained. These characteristics are more evident if the arm is raised vertically, and they can be well appreciated by grasping the wrist with the hand (Osler) instead of by the ordinary mode of palpation with the finger. In this disease there is also a capillary pulse: a phenomenon which may also be observed in neurasthenia and profound

anæmia, but much less often. It can be seen in the nails, in the vessels of the retina through the ophthalmoscope, upon a surface artificially reddened by firm rubbing as on the forehead, and it may also be well observed through a microscopical glass slide placed upon the everted lower lip. It consists of an alternate flushing and paling of the part, corresponding with the sudden filling and emptying of the vessels.

In rare instances there is even a centripetal venous pulse, seen best on the back of the hand.

**Diagnosis.**—As already stated, persons may have aortic regurgitation without symptoms; hence the disease may sometimes be discovered only upon physical examination. When the signs above enumerated have been detected, there is scarcely any doubt about the diagnosis.

A diastolic murmur at the base of the heart may be occasioned by an enlargement of the aorta, due to aneurism, but this lesion would have a different history and would present other signs peculiar to itself. Moreover, aneurism usually gives a systolic, rather than a diastolic, murmur. Examination with the x-ray would be conclusive.

Insufficiency of the pulmonary valves is a very rare lesion, and, if present, the murmur caused by it should be transmitted downward and to the right, and there would be no hypertrophy of the left ventricle or "water-hammer" pulse.

Patency of the ductus arteriosus is a rare condition, and the murmur associated with it has been described as "late systolic" or, again, as "continuous with the second sound, transmitted only very feebly to the left, and of a wavy character, sufficient of itself to distinguish it from an aortic regurgitant murmur."

At least 95 per cent. of the cases in which aortic reflux occurs the diastolic

murmur is heard much more loudly at the second left interspace close to the sternum than in the position usually assigned to it, namely: the second right interspace.

There is no heart-murmur which more often eludes detection than regurgitant aortic murmur. Of course, the ordinary loud sound of a double aortic murmur is audible without the least difficulty, and to this personal remarks do not apply. They are limited to that low-pitched, soft, aortic murmur which often accompanies, but does not replace, the second sound, and which is of evil significance.

The second left interspace close to the sternum is the locality in which the aortic reflux murmur is much more distinct than in the position ordinarily assigned to it. The point at which the murmur is loudest is almost invariably the middle of the sternum, and it is frequently very loudly audible just above the xiphoid cartilage. H. W. Sayers (*Brit. Med. Jour.*, June 1, 1901).

In pulsation of the uvula much caution is necessary in the examination, as muscular movements produced by attempts at retching or swallowing may simulate pulsatile phenomena. The patient should be instructed to hold the mouth open steadily and to breathe quietly. It is well to make the examination both with and without the use of a tongue-depressor.

Two types of pulsation of the soft parts are distinguishable: a communicated movement, connected with the throbbing of the carotids, and usually affecting the tonsils and faucial arches; and an independent movement, brought about by a systolic increase in the volume of the tissues. This manifests itself in a rhythmical turgescence of the soft parts. Schlesinger has observed the pulsation in the tongue, both by inspection and by palpation. It may likewise be discernible in the half-arches and in the uvula. At times the posterior wall of the pharynx is pushed forward with each systole of the heart; in some cases the swelling is so marked as to produce a distinct rhythmical nar-

rowing of the oral and pharyngeal cavities.

As a physical sign, pharyngeal pulsation has no special diagnostic value and possesses no greater significance than the capillary pulse. The knowledge of its existence merely adds one more point to be looked for in the critical study of a case. David Riesman (*Amer. Medicine*, June 15, 1901).

**Etiology.**—Aortic regurgitation is seen most often in middle-aged, vigorous men accustomed to considerable muscular exertion. It may be caused by endocarditis, but is more often of insidious origin in connection with habitual overstrain, and with the poison of gout, alcohol, or syphilis.

Atheroma of the aorta may extend into and deteriorate the valves.

The valves may be congenitally affected. In most such cases they are still competent at birth; but they are apt to become impaired in later life.

Ulcerative endocarditis may produce a sudden incompetency of the valve, with great and perhaps fatal embarrassment of the cardiac circulation, as already mentioned. And, finally, sudden muscular strain may produce a rupture of one of the segments, especially if the valve is previously impaired by disease.

**Pathology.**—Besides the usual changes in the valves themselves, there are lesions peculiar to aortic regurgitation in the heart and blood-vessels. As already stated, the heart becomes enormously hypertrophied, weighing 40 to 45 ounces instead of 10 or 12. The main part of this increase is in the walls of the left ventricle, the cavity of which is enlarged, but its walls more than proportionately thickened. The muscular trabeculæ of the ventricle are usually more or less flattened where the regurgitant blood-current impinges upon them.

While in all kinds of valvular lesions the heart is exposed to ultimate degen-



erative changes, this liability is particularly great in aortic regurgitation, because the coronary arteries upon which the nutrition of the heart-wall depends, originating, as they do, at the base of the semilunar valves, no longer have a normal amount of blood forced into them. Moreover, if the lesion of the valves is due to fibrotic changes, the orifices of the coronary arteries are apt to be involved in this process and more or less occluded. Hence those cases of aortic regurgitation have a decidedly better prognosis which are due to rheumatism than those which are associated with atheroma.

The systemic arteries become dilated by the large volume of blood which is thrown into them with each contraction of the enormous left ventricle, and they also undergo scierotic degeneration because of the strain which they experience.

**Prognosis.**—Aortic regurgitation is the most dangerous of the acquired valvular lesions of the heart. It is consistent with comfort and vigor lasting for years, but there is always the possibility of a sudden fatal termination; and, when once compensation has been interrupted, it is seldom satisfactorily restored. Sometimes upon the development of secondary mitral insufficiency there will be a noticeable alleviation of the cardiac embarrassment, but the patient is reprieved, not saved.

Sudden death in heart disease occurs in about one-quarter of the cases of aortic regurgitation. Thirty fatal cases of valvular disease have been personally observed with the average age of death for mitral stenosis at 50, for mitral insufficiency at 40, and for mitral stenosis and insufficiency at 36. In 250 cases of which records have been kept, its average duration in mitral insufficiency was found to be 5.1 years, in mitral stenosis, 11.5 years, in aortic stenosis, 7 years, and in aortic insufficiency 2.3 years. The

maximum duration was 17 years in mitral insufficiency, and in aortic stenosis 20 years. In aortic insufficiency it was only 4 years. The prognosis is also governed, to a certain extent, by the heart-sounds, a vigorous murmur, and first sound, being favorable. Congenital lesions usually do better than those that have been acquired. If the heart is greatly hypertrophied, the prognosis is less favorable. If there is anæmia or emaciation, or if there is a sudden obesity, the case is graver. The duration of broken compensation is very variable. In mitral insufficiency it averages 2.6 years; in stenosis, 3.6 years; in aortic stenosis, 3.8; in aortic insufficiency, 2.75 years. Unfavorable symptoms in lost compensation are anæmia, dropsy, and dilatation of the heart; but, when it occurs, the patients are usually more amenable to hygienic measures. In 139 cases of the 250 no satisfactory cause could be determined. In the remaining cases 54 were due to rheumatism, 15 to atheroma, 5 to chorea, and the others apparently to infectious disease. N. S. Davis, Jr. (*Med. News*, June 17, '99).

**Treatment.**—When the aortic valves are diseased from causes other than endocarditis, iodide of potash in doses of 5 to 10 grains thrice daily should be given for long periods. This applies to cases of stenosis as well as regurgitation.

Some writers have advised against the use of digitalis in aortic insufficiency, fearing the bad effect of lengthening the diastole and thus affording a longer time for regurgitation; but the weight of authority is undoubtedly in favor of employing digitalis when it seems to be needed, despite this theoretical objection.

Further suggestions will be found in the article in the previous volume on *DILATATION OF THE HEART*, and in general remarks upon the treatment of valvular diseases, below.

#### **Aortic Stenosis.**

**Definition.**—A lesion of the aortic valve obstructing the normal flow of

blood from the left ventricle into the aorta.

**Symptoms.** — Well-compensated aortic stenosis may last for years without subjective disturbances. When compensation begins to fail, the pulse may become very slow, even as slow as 50 to 25 beats a minute, and there is a great tendency to dizziness, faintness, syncope, and epileptiform attacks. The subjects of the disease are usually elderly persons with general arterial sclerosis. Upon inspection, the heart's apex may be seen downward and to the left from its normal position; but in some instances, when there is pulmonary emphysema or an unyielding chest-wall, no cardiac impulse can be seen or even felt.

Percussion may show some enlargement of the left ventricle. Change in the right side of the heart does not ensue until the later stages of the disease.

Palpation very often detects at the base of the heart on the right side a distinct rough, systolic thrill.

Auscultation discloses a rough, long-drawn, systolic murmur, heard best in the second right interspace, of a sawing character, and transmitted into the carotids. It is followed by the second aortic sound, unless there is also a diastolic murmur, when the latter may supplant the normal valvular sound. Often there is accentuation of the second aortic sound, particularly if there be chronic degenerative changes in the kidney.

The murmur is not invariably harsh. It may exceptionally be soft and blowing, or even musical.

**Diagnosis.**—A systolic murmur at the base of the heart may be heard in anæmia, but this is usually in young subjects, and loud upon the left as well as upon the right side of the sternum; and it is not accompanied by the characteristic thrill nor by hypertrophy of

the left ventricle. A systolic aortic murmur is heard very frequently in connection with the murmur of aortic regurgitation independent of any stenosis. This murmur is comparatively soft in character and unaccompanied by thrill. A systolic murmur may be heard in the aortic region caused by roughening of a calcified aorta without the existence of stenosis. Here we would fail to find enlargement of the left ventricle, or the peculiarly slow, infrequent pulse of stenosis. The systolic bruit of a thoracic aneurism, heard in the same region, would be accompanied by pain, dilating tumor, x-ray shadow, and other signs of the true condition, and not associated with the peculiar pulse or with any hypertrophy of the left ventricle unless there were co-existent aortic regurgitation. A mediastinal new growth may press upon the aorta in such a way as to cause a harsh systolic murmur, but without any necessary sclerosis of the arteries, as seen in aortic stenosis, and with a tumor to be detected by percussion and by the x-ray. Moreover, the blood-count might aid here in diagnosis.

The systolic murmur of pulmonic obstruction and that of patent ductus arteriosus are not transmitted into the systemic arteries.

**Etiology.** — In some cases the valves appear as if the lesion might have been congenital, but almost always the disease develops late in life, and is a slow, fibrous, and calcareous change in the valves associated with degenerative changes in the whole arterial system. The left ventricle is slightly dilated, but mainly hypertrophied.

**Pathology.** — Sometimes there is a subvalvular stenosis because of foetal endocarditis. There may be vegetations on the valves due to endocarditis. Usually the lesion is sclerotic or calcareous.



The coronary arteries may be involved, resulting in myocardial degeneration.

**Prognosis.**—The prognosis is comparatively favorable. Good health may be enjoyed for many years. When compensation begins to fail, sudden death, with cerebral symptoms, may occur.

**Treatment.**—Iodide of potash in small doses, long continued, may be of great value.

For further suggestions the reader is referred to the article in the previous volume on DILATATION OF THE HEART and to general remarks in regard to the treatment of valvular diseases, in following pages.

### Tricuspid Regurgitation.

**Definition.**—Insufficiency of the right auriculo-ventricular valve.

**Symptoms.**—The symptoms of tricuspid regurgitation are those seen in most cases of ruptured compensation, in valvular lesions of the left side of the heart, provided the patient lives long enough. They are headache, dizziness, indigestion, scanty urine, uneasiness in the right hypochondrium, wakefulness, cyanosis, anasarca, and orthopnea. Sometimes there is a peculiar greenish coloration of the skin, due to a slight icteric hue mingling with the cyanosis.

On physical examination we find by inspection a marked epigastric impulse, and by percussion a very extensive dullness to the right of the sternum. The characteristic murmur of tricuspid regurgitation is a soft, low, systolic murmur, heard best at the left edge of the sternum between the fourth and sixth ribs, and transmitted toward the right. It is seldom audible above the third rib. The incompetency of the tricuspid valves causes dilatation of the subclavian and cervical veins, and when this has become so great that their valves are no longer

competent, the veins pulsate with every systole of the heart. This pulsation may be seen sometimes even in the axillary, thyroid, and mammary veins. The same systolic centrifugal impulse is also transmitted downward into the liver, and this organ may exhibit an expansile pulsation with every cardiac systole.

**Diagnosis.**—The systolic murmur of mitral regurgitation is heard upon the left side of the sternum; as a rule, loudest at the apex; and transmitted toward the left axilla. If both the mitral and the tricuspid valves are incompetent, usually upon careful use of the stethoscope an area can be found, going from left to right, where the mitral systolic murmur ceases, and on further advance toward the right an area where the tricuspid murmur begins. Moreover, the latter murmur may be different in pitch and quality from the mitral murmur.

**Etiology.**—Tricuspid incompetency is usually secondary to dilatation of the right ventricle because of obstruction in the pulmonary circuit. This may be due to chronic bronchitis, pulmonary emphysema, fibroid induration of the lungs, or to mitral disease. Of these two classes of causes, the pulmonary are said to be of more unfavorable prognosis. Also, tricuspid regurgitation may be directly due to endocarditis. This may exceptionally affect primarily and alone the tricuspid valve, but it is mostly secondary to trouble upon the left side of the heart. If the endocarditis is ulcerative, there may be secondary pulmonary abscesses.

### Tricuspid Stenosis.

Tricuspid stenosis is an extremely rare condition, causing obstruction of the right auriculo-ventricular valve. It may be congenital, in which case it is associated with other lesions, so that the patient seldom lives long. If acquired, it is almost invariably associated with

other valvular lesions, particularly mitral stenosis.

Its symptoms are cyanosis, sensitiveness to cold, dyspnoea, and palpitation. A presystolic thrill has been observed, and a presystolic murmur, heard best at the base of the xiphoid cartilage or toward the right from that point.

The etiology and pathology are not different from those of the more common valvular lesions.

The prognosis is extremely unfavorable.

### **Pulmonary Stenosis.**

**Definition.**—Obstruction of the pulmonary valve.

**Symptoms.**—This condition is almost invariably congenital, and it is usually associated with other structural anomalies, such as persistence of the foramen ovale and of the ductus Botalli, and defects in the septum ventriculorum. Most cases come to an early termination. Life is seldom prolonged beyond fifteen years. The marked symptoms are cyanosis, dyspnoea, clubbing of the ends of the fingers, and deficient bodily development.

Upon auscultation we hear a loud, systolic murmur over a rather extensive area, but loudest in the second left interspace, and sometimes accompanied with a systolic thrill. The pulmonary second sound is weak or absent, or it may be replaced by a diastolic murmur. The systolic murmur is not transmitted into the arteries of the neck, but in some cases seems to extend toward the left shoulder.

**Diagnosis.**—It should be borne in mind that functional systolic murmurs may be heard in the second left interspace. They can be distinguished by the other physical signs and the age and general appearance of the patient. And it should also be remembered that sometimes the murmur of mitral regurgita-

tion may be heard along the left edge of the sternum; but the latter murmur may also be heard in its usual position near the apex or in the back near the angle of the scapula. Moreover, the general symptom-complex would doubtless aid in distinguishing the true lesion.

**Prognosis.**—The prognosis is always unfavorable. Beside the impending cardiac failure, such patients are notably predisposed to pulmonary tuberculosis.

### **Pulmonary Regurgitation.**

Pulmonary regurgitation is an excessively rare valvular lesion which is said to be accompanied by a diastolic murmur heard best over the pulmonary area, and transmitted downward and toward the xiphoid cartilage. It is usually associated with pulmonary stenosis or with some lesion on the left side of the heart. As distinguished from aortic regurgitation, it does not present the arterial and capillary symptoms of that disease, nor the striking hypertrophy of the left ventricle.

High pressure in the pulmonary artery may give rise to a functional leak in the pulmonary valves (Graham Steel, Barr, Gibson, and others). For instance, this may be heard in some examples of mitral stenosis. In this case we have the picture of the principal organic lesion to show us the proper diagnosis.

### **General Remarks Upon the Treatment of Valvular Diseases.**

Our first effort must be to promote and maintain perfect compensation of the valvular lesions. Our most important means to this end is control of the diet and of the bodily and mental activities. The diet should be simple, nutritious, easily digested, and the amount taken at any one time should be moderate. A considerable proportion of nitrogenous elements is desirable; sugar and starchy foods should be used spar-



ingly. Thirst should mainly be quenched with pure water; this, again, is better taken frequently in moderate amounts than in excessive draughts. Tea is to be forbidden. Coffee may be enjoyed in moderate quantity if its effects do not prove unfavorable. Cocoa, milk, soups, and broths are suitable elements of the diet. In elderly and feeble persons, and in those previously habituated to its use, a moderate amount of alcohol may be advantageous; but, in general, its daily employment is harmful. Mental strain, overwork, worry, and excitement, even if pleasurable, shorten the prognosis of comfortable existence. Physical exercise should not be summarily interdicted; its kind and amount should be most carefully determined in each individual case, and—above all—its effects alertly observed for future guidance. The moderate employment of many muscles is, of course, much better than the undertaking of special feats of strength. Walking and horseback-riding are suitable. Golf can be recommended for many patients with moderate lesions. The bicycle, if used, should be of low gear, and the patient should be warned against long journeys and against mounting hills. Facing a high wind has proved harmful, and even fatal, to cardiac patients. When ordinary exercise is no longer wise, massage and passive movements may be of great benefit; also stimulating baths, as those of Nauheim. Many patients are anæmic, and are benefited by iron, and others by arsenic; but this latter drug should not be used where there is any suspicion of tendency to fatty degeneration. Cases which evince a liability to pulmonary disturbance (especially mitral diseases) should be guarded against exposure to cold and wet.

If sudden cardiac failure develops, particularly in mitral cases, the abstrac-

tion of ten or twenty ounces of blood may save life. If the symptoms are less urgent, analogous relief may be obtained by a purge, in which case calomel seems particularly efficacious.

When in mitral stenosis the symptoms are very urgent, venesection may be of striking service, and in certain cases there is no other treatment that will take its place and avert a speedy, fatal termination. The contrast between the powerful right-ventricle impulse and the small, weak, irregular pulse, is very striking, and is one of the most important indications for venesection. Venesection does not, however, dispense with the necessity for relieving the portal circulation by purgation. Stimulants which without these measures afford no relief, and may, indeed, do harm, will then be of the greatest service, and digitalis, and like remedies, will find their opportunity. W. H. Broadbent ("Heart Dis.," 1900; Phila. Med. Jour., July 7, 1900).

When the signs of failing compensation are more gradual, our best remedy is complete rest in bed. A fortnight or two thus spent may fully restore compensation, independently of any drugs.

In cases which have advanced still farther downward, either in spite of or before our ministrations, the treatment becomes the same as that already described at length in the article on DILATATION OF THE HEART; but, for the sake of completeness, it may be said that our best cardiac stimulant is digitalis. This is indicated when the heart's action is feeble and ineffective, particularly if rapid and irregular.

If there is considerable dropsy, digitalis will work to much better advantage if preceded by free purgation with calomel, blue mass, or a concentrated solution of sulphate of magnesia. The mercurials seem to possess a peculiar power of dilating the arterioles, which other purgatives do not have. Digitalis is much more effective if great bodily quiet

is enforced during its administration. If given at all, its dose should be such as experience finds suitable in the particular case in hand. If an ordinary dose does not seem to be of much benefit, gradually-increasing amounts should be given until either there is improvement in the pulse or some toxic effect appears.

Nausea and diminution in the amount of urine are signs that the drug had better be omitted. Some excellent observers believe that better results can be obtained from the use of the digitalis-leaves themselves, or an infusion made from them, than from the tincture. An easy way to obtain a fresh infusion for the patient is to order powders of digitalis, each one of sufficient size to make an infusion for twenty-four hours' use. No alkaloid of this drug appears to represent all its beneficent powers. In some instances, where there was obstinate vomiting, digitalis has been given with advantage by enema. When the heart appears to have come under its influence, we must be prepared to interrupt its administration as soon as there is any diminution in the secretion of urine or tendency to nausea or to a fresh irregularity of the pulse.

If digitalis, after a careful and persistent trial, proves unavailing, recourse may be had to tincture of strophanthus, caffeine, sparteine, adonidin, or convallaria majalis; but, unfortunately, these are seldom of great advantage. Strychnine is a valuable, general, and cardiac tonic. It may be used to supplement other treatment, and also subcutaneously in case of dangerous collapse.

Nitroglycerin will often give great relief to cardiac distress and to dyspnoea, particularly where the pulse is hard or where there is cyanosis.

In case of marked dropsy diuretin will

sometimes prove very valuable. Another suitable remedy is a pill composed of 1 grain each of squill, digitalis, and blue mass, administered three times a day. If the kidneys are practically intact, calomel may be administered as a diuretic in the dose of 3 grains every three hours until effect: either decided purging or marked diuresis. The likelihood of purging may be diminished by combining, with this dose of calomel, opium in the amount of  $\frac{1}{2}$  to 1 grain. In case there is a considerable collection of fluid in one or more of the serous cavities of the body, aspiration may give great temporary relief and enable the heart to recover some of its lost power; and, when the legs are extremely œdematous, the use of Southey's tubes or scarifications under strictly antiseptic precautions may be of great advantage.

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## VARICELLA.

**Synonym.**—Chicken-pox.

**Definition.**—A mild, contagious, eruptive fever, occurring chiefly during childhood and youth. The name varicella was applied to this disease early in medical history, before it had been fully differentiated from variola.

**Symptoms.**—After a period of incubation, varying, in different cases, from ten to seventeen days, the child generally feels slight chilliness. This is followed by two or three degrees of increased temperature, slight pains in the head and back, and general lassitude. In twenty-four or thirty-six hours a strictly vesicular eruption appears more upon the trunk of the body, but some on the face and neck. The feverish symptoms continue, and new vesicles appear, especially on the face and scalp, for three days, when new vesicles cease to appear and the gen-



eral feelings of indisposition quickly disappear. The vesicles have no hard or indurated base, are mostly ovoid in shape, and filled with a slightly-turbid serum.

They never become confluent, and are at no time surrounded by a red areola of inflammation and tumefaction. Each vesicle begins to shrivel or dry up in twenty-four or thirty-six hours after it appears, and forms a thin, light-brown scab. Consequently the first vesicles are often seen dry when the later ones are just appearing. In five or six days the eruption has all become dry and the scabs fall off, generally leaving no indentations or permanent scars. In a small percentage of the cases, however, a very few distinctly pitted and permanent scars have been left, these probably resulting from scratching or otherwise causing inflammation to extend deeper into the cutis vera. The duration of the disease from the first indications of fever to complete convalescence is generally from seven to ten days. Very rarely the vesicles appear in the mouth and fauces, and cause much annoyance to the child in eating. In a large proportion of cases the appearance of vesicles on the skin is preceded a few hours by small, red spots. A very few cases have been reported in which the eruption has presented an hæmorrhagic condition. Cases have also been recorded in tuberculous, anæmic, and otherwise unhealthy children, and leaving gangrenous, phagedænic, or troublesome sores. But varicella occurring in previously healthy children rarely is followed by any troublesome sequelæ.

**Diagnosis.**—The chief interest connected with cases of varicella is in its diagnosis or correct differentiation from the exanthematous fevers: rubeola and scarlatina, on one side, and from variola on the other. From rubeola it is at once distinguished by the absence of cough

and catarrhal symptoms and the appearance of eruption on the second instead of the fourth day. From scarlatina it is distinguished by the mildness of the febrile symptoms and the absence of intense redness and soreness in the fauces; and from both it and rubeola by the eruption appearing in plain, scattered vesicles containing fluid instead of mere red points or exanthems. From variola it is differentiated by the absence of three full days of active fever and severe pain in the back and head before the eruption appears. The latter presents at once an oval vesicle without any hard, elevated base as in variola; and as it progresses it begins to shrivel, then dries up in two days, and has disappeared before a variolous papule would have completed its development into a pustule. An attack of varicella affords no immunity from variola, neither does an attack of variola, varioloid, or vaccinia afford immunity to varicella. There are, therefore, no etiological relations between chicken-pox and small-pox.

Varicella is often preceded by a scarlatiniform rash, but, while true scarlatina is always followed by desquamation, this is never the case in varicella. Leon Cerf (Presse Méd., Oct. 6, 1900).

**Etiology.**—There are no known causes of varicella other than its own special contagium evolved in the body of the sick, and communicated to those with whom they may be in contact. It prevails chiefly among children, and in epidemic periods, only seldom attacking persons during adult life.

**Prognosis.**—Uncomplicated varicella rarely, if ever, terminates fatally.

**Treatment.**—Rest, in clean, well-ventilated rooms, at a comfortable temperature, with a plain, digestible diet, and strict personal cleanliness, is all the treatment required in a very large majority of cases of varicella. If a case is met

with during the eruptive stage with scanty and high-colored urine and inactive bowels, a solution of bitartrate of potassium in cold water and rendered palatable by the addition of sugar, may be given in doses suited to the age of the patient until the kidneys act more freely and the bowels are moved.

If the vesicles appear so numerous on the face as to cause much heat or discomfort, they may be kept moist with an equal mixture of glycerin and rose-water.

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### VARIOLA (SMALL-POX), VACCINATION, AND VARIOLOID.

#### Variola.

**Definition.**—An acute general febrile affection accompanied by characteristic eruptions on the cutaneous surface and propagated by a specific contagium.

**Symptoms.**—After a period of incubation varying from nine to fourteen days the active symptoms of variola commence abruptly by a chill of varying degrees of severity, from mere chilliness to profound cold, continuing half an hour or more, during which the face is pale, with a leaden hue of the prolabia and fingers; respirations unsteady; pulse small, frequent, and variable; severe pain in the loins, extending in severe cases to the head and epigastrium, with vomiting. At the end of the cold stage active febrile reaction supervenes; the face becomes flushed with suffused redness; the skin generally hot and dry; pulse moderately full and frequent; respirations accelerated; pains in the back and head more severe; epigastric distress and vomiting more frequent, with great restlessness and sometimes delirium. The tongue is generally covered with a white fur, the bowels inactive, and the urine scanty and high colored.

Study of the urine of 1400 cases of small-pox, showing that albuminuria should be considered an almost constant accompaniment of small-pox. Positive reactions were obtained in 95 per cent. of the cases, and in 32 per cent. abundant quantities were present. The maximum amount corresponded in general to the early febrile period. Rarely the curve of the albuminuria reaches its acme at the time of suppuration or during desquamation. Such cases were of more unfavorable prognosis, and frequently had an exacerbation of the albuminuria during convalescence. It was frequently observed that there was an increase in the amount of albumin at the time of the urinary crisis and under the influence of increase in diet or of leaving the bed. Albuminuria persisted in 75 out of 100 cases in small amounts, even during convalescence. As a general rule, albuminuria is more abundant in grave cases, and the grade of the albuminuria is a useful factor in prognosis.

It is believed that the albuminuria of small-pox is not simply functional, but due to an alteration of the renal tissue.

The inflammation of the kidneys is susceptible of recovery in mild cases, but more frequently a slight permanent lesion persists, usually a sclerosis, followed by some degeneration of the epithelium, and with this there exists albuminuria or a tendency to albuminuria. François Arnaud (*Revue de Méd.*, May 10, '98).

All the foregoing febrile symptoms generally increase in intensity for three full days, when the temperature is, in many cases, from 40° to 41° C. (104° to 106° F.), and the pulse from 100 to 120 per minute and full. In all except the more malignant cases the active febrile symptoms rapidly decline during the night of the third day, and after some sleep the patient is found on the morning of the fourth day quiet, nearly free from fever and pain, the skin a little moist, and urine more abundant. At the same time there is seen on the forehead, face, sides of the neck, and over the upper part of the sternum an eruption



of small, hard papules, looking like small, red spots, but distinctly elevated and hard to the touch. After a few hours there appears a small vesicle filled with water-colored serum on the apex of each papule. The eruption, thus began, continues to multiply and extend over the whole cutaneous surface, reaching the extremities nearly twenty-four hours later than on the face and neck. Both the vesicle at the apex and the hard papule on which it rests increase in size for three days, during which time each vesicle becomes filled with serum, flattened on the surface, and distinctly depressed or umbilicated in the centre. At the end of the third day of the eruption, the seventh from the initial symptoms of disease, inflammation attacks each point of eruption, causing an areola of redness around its base, with tumefaction and heat, and a return of some general fever and restlessness. At the same time the serum or virus in the vesicles begins to be turbid or less transparent, and to accumulate in quantity for three or four days, when each vesicle loses its umbilicated appearance and becomes a pustule filled with purulent-looking fluid, and marks the completion of the suppurative stage. In cases of average severity the tumefaction accompanying this suppurative stage is sufficient to cause much swelling of the face and closure of the eyelids, and in many places the pustules merge into each other, constituting confluent patches, especially on the face, upper part of the chest, and backs of the hands. In such cases during the suppurating stage the febrile symptoms are more analogous to those of the typhoid type. The temperature ranges between 38° and 40° C. (101° to 104° F.); the pulse from 110 to 130 per minute, soft or weak; mind dull and sometimes wandering; tongue dry along

the middle; bowels generally quiet, though sometimes loose; and the urine still scanty and high colored. At the end of the suppurative stage, which is from ten to twelve days after the commencement of the disease, if the case is progressing favorably, all the general febrile symptoms rapidly abate, the urine becomes more abundant, the patient takes nourishment more freely, the mind is more active, and the pustules begin to dry up, as shown by a dark-brown spot in centre of each. This brown spot increases in size from day to day, until the whole becomes a dry brown crust or scab, and the tumefaction of the surface has disappeared. The process of desiccation and cicatrization of the pustules occupies about one week, after which the scabs become rapidly detached, leaving the surface clean, but covered with depressed or pitted scars that often remain through life. Such is the usual course of an average case of variola, the whole time occupied, from the initial chill to complete cicatrization, being about twenty-one days. Cases, however, vary much in severity and in their results. In some the amount of eruption or number of pustules is so limited that each remains separate from its fellows throughout the course of the disease, though each passes through the several stages described. But the suppurative stage is accompanied by less swelling of the face and less secondary fever, as well as less general prostration. Such cases are called distinct, or discrete, small-pox, and constitute the mildest variety of the unmodified form of the disease. On the other hand, many cases occur in which the premonitory fever is more intense, and the eruption so copious that in its development the pustules coalesce or become confluent over the greater part of the cutaneous surface; some pustules appear also in

the mouth and fauces, thereby adding much to the discomfort of the patients; and with the commencement of the suppurative stage the respiration becomes unsteady and sometimes sighing; the pulse from 120 to 140, small and weak; temperature from 41° to 43° C. (106° to 110° F.); and much delirium. At this stage in many of these cases petechial or hæmorrhagic spots appear upon the surface, or blood oozes from the gums, or sudden and copious hæmorrhage from the bowels occurs, followed by speedy collapse and death before the end of the suppurative stage. In other cases of the confluent variety, with the commencement of the suppurative stage, pneumonia supervenes and determines a fatal result before the end of the second week in the progress of the disease, though some cases recover.

There is still another class of cases of variola which have been properly called malignant. These cases are characterized by extreme depression of all vital functions from the initial chill to the end. The patient suddenly becomes cold, with blueness or leaden hue of the surface; a very frequent, variable, and weak pulse; shallow and hurried breathing; intense pain in the loins, head, and epigastrium, with frequent retching or efforts to vomit, and constant delirium or stupor. With the febrile reaction all the symptoms named, except the coldness, are increased, and during the second day the urine is very scanty or suppressed; the matter vomited, bluish or dark color, with streaks of blood; erythematous or purplish spots appear on different parts of the surface, or, instead, the whole surface becomes covered with an exanthematous rash, with here and there a petechial spot. During the third day the anomalous spots, whether erythematous or exanthematous, begin to

disappear, and the true, pointed papules of variola begin to appear; and by the following morning the entire cutaneous surface is thickly studded with them; many of them infiltrated with blood at their base, giving them a blackish appearance. But the appearance of the variolous eruption is accompanied by no subsidence of fever or general improvement, as in milder cases. On the contrary, the pulse becomes more rapid and feeble, the respirations irregular and inefficient, intestines discharge involuntarily, and renal secretion suppressed, and death follows generally between the third and sixth day of the disease. In all the severe grades of variola, during the suppurative stage and the subsequent desiccation, a very disagreeable and peculiar odor emanates from the body of the patient, making strict attention to ventilation and the use of disinfectives necessary. In the cases with numerous pustules in the mouth and fauces there is much flow of saliva, more or less painful deglutition, with some tendency to broncho-pneumonia or œdema of the glottis, especially near the completion of the suppurative stage.

**Diagnosis.**—An abrupt attack of active fever without previous feelings of indisposition, and characterized by suffused redness of the face and neck and intense pain in the loins, should suggest to the mind of the physician the possibility of an attack of variola. There is not, however, any positively diagnostic symptom of this disease until the appearance of the characteristic eruption, usually on the fourth day. The positive elevation and hardness of each papule constituting the eruption readily distinguishes it from any of the exanthematous fevers, while the minute vesicle on the apex of the hard papule equally distinguishes it from the larger vesicles



without any hard base of varicella. The absence of cough and notable catarrhal symptoms farther separates it from rubeola.

When the variolous vesicles have progressed far enough to show the distinct umbilicated depression in the centre their diagnostic features are complete. Bacteriologists have thus far been unable to find any microbe distinctively associated with this disease.

**Etiology.**—The specific or essential cause of variola is a contagium generated in the body of the sick sufficient to impregnate the blood, the secretions, and the exhalations, and to render the air surrounding the patient contagious. As the disease progresses the contagion accumulates in the serum and purulent matter of the pustules, and remains active in the dry scabs and adheres to clothing. If such scabs or infected clothing are freely exposed to fresh air, the activity of the contagium gradually diminishes until it is lost; but if they are kept in vessels or closely packed trunks or boxes they may be carried from one country to another and preserve their contagiousness a long period of time. The etiological element of variola has recently been traced to a parasite by Councilman, but the investigations are as yet unfinished.

**Pathology.**—When a portion of the specific contagium or poison of variola is received into the living body susceptible to its action, it requires a period of from nine to fourteen days to multiply or develop sufficient to cause any disturbance or manifestation of its presence. When this period of incubation is completed the contagium rapidly develops an active irritative action on both nervous and vascular structures and thereby establishes a general fever of greater or less intensity. The contagium, however, by

its manifest affinity for the cutaneous tissue and the mucous membrane of the mouth and fauces, rapidly finds lodgment therein to such an extent that, in a large majority of cases, the blood in from three to four days is so far relieved of its presence that all the active febrile symptoms have disappeared. But at the same time the virus at each point of its deposit in the cutis vera starts a local inflammation that presents the form of a hard elevation or papule with a minute vesicle on its apex, and goes through the subsequent stages already described under the head of symptoms. If the contagium evolved during the period of incubation is so large that it fails to find complete lodgment in the cutaneous surface, or from any other cause is retained in the blood, the fever does not subside with the appearance of the eruption, the blood rapidly undergoes deterioration, and the case soon presents a malignant aspect and death generally follows. The nature of the pathological changes produced by one impression of the variolous contagium on the human system is such that one attack of the disease renders the individual permanently immune to subsequent attacks. In a small percentage of the cases the immunity gradually diminishes, and after several years the system again becomes susceptible to the contagium; but the second attack is generally milder and of shorter duration. Such second and modified cases have been termed *varioloid*, and seldom terminate fatally. But they evolve the genuine variolous contagium, and consequently communicate genuine unmodified variola to persons not previously protected.

The writer studied 5 cases of small-pox at autopsy and concludes that the early skin lesions indicate that the primary infection in small-pox takes place in the lungs, probably by inhalation.

The poison, when it enters the circulation, shows a selective influence on the epithelium of the skin and respiratory tract, and many cases are probably not further affected. The serious and fatal lesions of smallpox are caused by the secondary infection from the skin and respiratory tract, and the infectious agent is usually the *streptococcus pyogenes*. This organism is so distributed throughout the lesions as to explain most of the visceral changes, such as thrombosis, local necrosis, and the various pulmonary changes. This *streptococcus septicæmia* is the most striking feature of fatal smallpox, and if it were possible to overcome this condition by a special serum, the mortality from the disease would be greatly reduced. W. R. Stokes (Bulletin Johns Hopkins Hospital, Aug., 1903).

**Prognosis.**—Unmodified variola is always a serious disease. The ratio of deaths resulting from it is much greater, in both childhood and old age, than through the middle period of life. Cases properly designated as distinct, or discrete, variola quite uniformly recover.

Cases presenting only a limited degree of confluence of the pustules on the face and backs of the hands also tend toward recovery, unless pulmonary or renal complications occur. But cases presenting a very general confluence of the eruption or strongly hæmorrhagic and other symptoms of malignancy, result in a high ratio of mortality. The existence of pregnancy in females increases the danger of a fatal result to the mother, often preceded by abortion or premature delivery. Considering all grades of the disease as they occur in different epidemics and in various countries, the ratio of deaths may be said to vary from 10 to 50 per cent. of the whole number of attacks. The chief complications that influence the ratio of mortality are pneumonia, uræmia from renal conges-

tion, endocarditis, intestinal hæmorrhage, and œdema of the glottis.

**Treatment.**—As variola is well known to be caused by a specific poison or contagium which requires a period of incubation or evolution of from one to two weeks before any symptoms of disease become manifest, this is evidently the time when by a prompt resort to vaccination and active administration of such antidotes or antiseptics as the hyposulphites of sodium or calcium we might expect to prevent, or, at least, greatly lessen the amount of contagium evolved, and thereby either wholly prevent the attack or render it so mild as not to jeopard the life of the patient. Unfortunately but few patients seek medical advice during the period of incubation or even know that they have imbibed the contagium until its evolution is complete and active febrile symptoms have commenced. And, in the relatively few cases in which the time of exposure to the contagium is known and medical advice is sought early, immediate vaccination with cow-pox virus is generally the only remedial agency resorted to. This, though of the utmost importance if practiced efficiently during the first five or six days of the incubative period, is generally of no use when resorted to later in that period. But there is much evidence in favor of doing more than this. Through the whole period of incubation the patient should abstain entirely from the use of alcoholic drinks; eat moderately of plain, digestible food; sleep in clean, well-ventilated rooms; take a fair amount of exercise in the open air daily; and see that the functions of the skin, kidneys, and liver are maintained at their natural degree of activity. But all violent evacuating measures should be avoided, and also all excessive fatigue of body or mind.



That such attention to strictly hygienic measures during the whole period of incubation is capable of rendering the active stage of the disease much milder is shown by the marked diminution of mortality from the disease in Europe after the introduction of the practice of inoculation by Lady Mary Wortley Montagu in 1718. This practice consisted in inoculating persons when in good health with the virus of variola and keeping them under good sanitary and hygienic regulations through all subsequent stages of their progress, and resulted in rendering the disease so much milder that the practice was applied extensively to new recruits of armies, before permitting them to enter upon important campaigns. During our own war for independence many of the new regiments were held in well-regulated camps and subjected to inoculation and rigid care until convalescence was completed, and the statistics show but a very small ratio of mortality, while the immunity acquired was as durable and complete as when the disease had been taken in the natural way. The discovery and demonstration of the protective power of cow-pox virus by Edward Jenner in 1798 very soon rendered all further inoculations with variolous virus unnecessary and unjustifiable, but it did not warrant the neglect of careful attention to the proper management of all patients during the incubative stage of variola.

During an unusual prevalence of variola in Chicago between 1850 and 1860, an opportunity was afforded in several cases to control the management of the greater part of the incubative period, and in addition to immediate vaccination and proper attention to hygienic rules each adult was required to take from 10 to 15 grains of hyposulphite of sodium dissolved in mint-water, less, in propor-

tion, to children, three or four times a day, for the purpose of preventing or, at least, lessening the evolution of contagium in the system. In some of the cases the vaccination took sufficiently early to prevent the development of variola. In other cases it was practiced too late and did not take effect. But, in every instance thus treated, if variola followed it presented only a mild aspect and terminated in recovery. In two instances coming under my observation in which two women, each with a nursing child, lived continuously in the same rooms with two cases of well-marked variola throughout the whole course of the disease. Both mothers had been rendered immune from having had varioloid in their youth. The infants, however, had not been vaccinated, but had been fully exposed to the active stage of variola three days before their condition had been discovered. They were immediately vaccinated, given each 3 grains of hyposulphite of sodium three times a day; their only diet was their mothers' milk; the rooms were kept as clean and as well ventilated as possible, while the mothers continued to care for those sick with variola in the same rooms. The vaccination did not produce any effect, and both infants continued in good health, neither presenting any symptom of fever or eruption.

When the stage of incubation has passed and the evolution of variolous virus has been completed, producing a fever of greater or less intensity, the leading objects to be accomplished in the management are: 1. To secure as complete isolation of the patient as possible, either in his own room or by direct removal to a hospital for such cases. 2. To exclude from the room all unnecessary furniture and clothing, and to maintain strict cleanliness, ample ventilation,

and disinfection. 3. To lessen the intensity of the fever and mitigate the severity of pains and restlessness, and at the same time to promote natural excreting activity of the skin, kidneys, and other secretory organs. 4. To sustain the patient by simple nourishment suitable for the several stages of the disease. The best means for accomplishing the third object just named during the pre-eruptive fever are frequent sponging of the surface with cool water and the giving of a gelatin capsule containing 1 grain of calomel and  $\frac{1}{4}$  grain of morphine sulphate, every four hours, and 2 minims of tincture of aconite-root half-way between the capsules. At the end of twenty-four hours, if the bowels have not moved, instead of continuing the capsules give the patient sufficient liquid citrate of magnesia to move the bowels moderately, or accomplish the same purpose by rectal enemata of warm water containing a little chloride of sodium. If, when the eruption of variolous papules appears on the surface, the active febrile symptoms and the pains in the back and head disappear, all active internal medication should be discontinued and strict attention given to the administration of simple nourishment, consisting chiefly of good milk and plain meat-broths salted to suit the taste of the patient, and the maintenance of rigid sanitation. When, on the third or fourth day of eruption, inflammation supervenes, with only a very moderate rise of temperature and there is but little or no confluence of the pustules, the same hygienic and sanitary measures, without medicine, may be continued until convalescence is established. If, however, the eruption is more copious and the suppurative stage accompanied by more fever and restlessness, from 6 to 10 grains of pulverized

Dover's and 2 grains of pulverized gum-camphor may be given each evening, and 10 grains of hyposulphite of sodium with 5 minims of tincture of belladonna dissolved in mint-water may be given three times a day until the stage of desiccation has fairly commenced. If necessary, the bowels can be moved at suitable intervals by warm salt-water enemata, and as the process of drying up and cicatrization of the pustules goes on a greater variety of food may be taken.

Pock-marks are thickest on parts of the body, such as the face, most exposed to light; hence the custom has been introduced into practice of leaving the patient in total darkness. Finsen some years ago suggested the exclusion of the chemical rays of light by using red glass over window-panes, or at least red curtains.

The exclusion of the chemical rays must be absolute; even a brief exposure to daylight may produce suppuration and its sequelæ. The skin must be treated, therefore, as one would a photographic plate. If red window-glass is employed, it is necessary for it to be of a deep-red color, and if curtains are used they must be very thick or in several layers. When the patient takes his meals, or during the physician's rounds, artificial light—for instance, faint candle-light—may be used without any danger. As even a brief exposure to daylight can produce suppuration, in order that the treatment may be carried out correctly it may be necessary to nail the curtains to prevent meddlesome interference by attendants. E. P. Joslin (Boston Med. and Surg. Jour., Nov. 16, '99).

Priority claimed in the use in small-pox of local applications of watery solutions of corrosive sublimate. In the eyes, nose, fauces, and ears a spray of peroxide of hydrogen is used. T. C. Osborn (Tex. Med. Jour., Med. Standard, Feb., 1900).

Bichloride baths used in 36 cases, of which 1 was hæmorrhagic and 13 con-



fluent, without mortality. The method employed was as follows: A six-foot bath-tub was placed beside the patient's cot and filled with a fairly warm—103- to 105-degree—solution of bichloride, 1 to 10,000, and the patient placed therein, head and shoulders above the solution; the nurse then went over the entire body, using a soft cloth, being careful of force applied so as not to cause much pain. After remaining in the bath about ten to twelve minutes, the patient was removed, thoroughly dried, dressed in freshly laundered clothing, and placed in a clean bed. These baths were given night and morning. After removal from the bath the patient expressed much relief, but shortly after, owing to the drying effect, complained of a burning sensation "just beneath the skin." All were likewise affected; so, to obviate this, a routine practice was begun of anointing patients immediately after the bath with a mixture of carbolic acid, bismuth subnitrate, and olive-oil, with a very happy result.

The authors outline the following advantages: The suppurative fever can be shortened four to six days if patient is treated from the onset; a minimum of pitting is secured and an almost entire absence of the characteristic, disagreeable odor; the period of desquamation is materially lessened, owing to the thinness of the scab-formation; pain is much reduced, morphine being rarely indicated; the great distortion of features, which gives such repulsive-looking patients, is eliminated to a great extent. R. L. Yaeger and H. A. Ingalls (*Jour. Amer. Med. Assoc.*, Apr. 28, 1900).

In the more decidedly-malignant cases—in which the pre-eruptive fever is intense, with great epigastric distress, persistent vomiting, delirium, and very scanty urine; and when the eruption appears, it is accompanied by petechial or hæmorrhagic spots and no abatement of the fever—there is but little chance or hope of averting an early fatal result. The most promising means are a cold

pack, to be followed by frequent sponging of the surface to reduce the temperature and the capsule of calomel and morphine every two hours until the epigastric distress and vomiting are relieved. If the bowels are inactive they may be evacuated by large, warm, salt-water enemas. If diarrhœa already exists, it has been sometimes controlled by repeated small enemas of normal salt solution to which were added from 15 to 30 minims of tincture of opium. If the patient lives through the first week of the disease and the stomach and bowels have become quiet, the greatest care should be given to sustaining him with small and frequent doses of good milk alternated with meat-broth well salted; a dose of Dover's powder and camphor at evening to promote rest, and appropriate doses of strychnine and digitalis to sustain the functions of the vasomotor and respiratory nervous systems through the subsequent stages of the disease. If, during the suppurating stage of the pustules, intestinal hæmorrhage occurs, an emulsion containing suitable proportions of oil of turpentine, oil of gaultheria, and tincture of opium has afforded more relief than any other remedy I could use. If not retained by the stomach it may be given as an enema with 2 or 3 ounces of beef-tea, and repeated soon after each evacuation. Perhaps the best external treatment of the eruption after it has become established in the skin, both for disinfection and to lessen the resulting pits or scars, is to keep the face covered with layers of surgeon's lint wet in a 1- or 2-per-cent. solution of carbolic acid, and the same solution may be applied over the whole surface once or twice a day. The nostrils should be carefully cleansed and kept as free as possible. If pustules appear in the mouth and fauces, mucilaginous and mild antiseptic gargles

should be used freely. If many pustules appear on the scalp, the hair should be cut short to prevent it from becoming matted together and foul during the suppurative stage.

Personal experience includes 4000 cases of small-pox with an average mortality of 0.11 per cent. The chief measures in treatment consisted of plenty of ventilation, the use of cooling acid drinks, and ice. Puncturing the pustules, the use of masks, and the like were found valueless procedures. The elasticity of the skin should, instead, be improved and the tension lessened by rubbing with oil. The danger of corneal ulcers and other ocular complications is lessened by painting the inside of the eyelids with a paste made from the extract of belladonna. J. Moir (Edinburgh Med. Jour., June, '98).

In 36 cases of variola, of which 1 was hæmorrhagic and 13 confluent, treatment by bichloride baths reduced the mortality to *nil*; the suppurative fever was shortened four to six days when the patient was treated from the onset. H. A. Ingall (Jour. Amer. Med. Assoc., Apr. 28, 1900).

Xylol in doses of 15 drops in red wine four to six times daily, and external applications of 1 per cent. carbolized vaseline or cold cream, are highly recommended by the writer. In all of the 6 cases under observation the treatment was commenced during the eruptive stage, on the second, third, and even the fourth day of eruption. Not a single patient developed pustulation. If some of the vesicles commenced to suppurate prior to the commencement of the treatment (usually on the scalp and face), pustulation did not advance and the pus underwent caseation. The vesicles with the caseated contents did not suppurate, but became concentrated and dried up, leaving a thin superficial scab. The eruption which appeared at the beginning of the treatment in the form of nodules remained in that condition without becoming vesicular. The course of the disease was either afebrile, and if fever did develop it was of an extremely irregular type, having in no case lasted more than four days from the com-

mencement of the treatment. In none of the patients thus treated did any scarification remain, although no precautions were taken to prevent this. I. K. Vischnevsky (Russky Vrach, Feb. 8, 1903).

During convalescence the patient should be bathed with slightly-warm water daily with carbolic or resinol soap until all roughness has disappeared.

### **Vaccinia (Cow-pox; Vaccination).**

**Definition.**—Vaccinia is a disease of the cow, characterized by the formation of pustules containing a virus which, if properly used, is capable of rendering man more or less immune to the contagium of variola.

**History.**—Edward Jenner, a practicing physician of Gloucestershire, England, after a long and faithful investigation, published in 1798 a complete demonstration that the cow is sometimes attacked by a mild febrile disease accompanied by pustules on the udders filled with a serous fluid or virus which, if, by either accident or design, was introduced into a cut or abraded spot would produce the same disease in the human being, and thereby render him immune to the small-pox. He further demonstrated that the virus or lymph in the pustules produced by vaccination from the cow-pox could be perpetuated indefinitely by vaccinating with virus from one individual to another and thereby render it available for perpetual protection against the prevalence of variola, then the most dreaded scourge of the human race. The same year that Dr. Jenner published his great discovery its practice was introduced into London by Mr. Cline, and the following year, 1799, it was introduced into this country by Dr. Benjamin Waterhouse, of Boston, Mass., and in a very few years it was approved and practiced in every civilized country in the world. During the first



half-century after the adoption of vaccination as a preventive of variola the vaccine-lymph, or virus, was propagated by taking it from the vaccine-vesicle on one person to vaccinate others, and it was called humanized vaccine-virus. But as time passed suspicions multiplied that the protective power diminished by the successive transmissions through the human system, and also that it was liable to be vitiated if developed in persons affected by syphilitic or other constitutional diseases. In 1866 a case of genuine cow-pox was discovered at Beaugency in France, and under the direction of M. Depaul, of the French Academy of Medicine, the fresh virus was secured and multiplied for vaccinating from one heifer to another, for the purpose of furnishing a sufficient amount for general use. In 1870 Dr. Henry A. Martin, of Boston, Mass., obtained some of this Beaugency stock of virus and commenced keeping a number of heifers for propagating and multiplying it as pure bovine virus to be used for protective purposes instead of that which had become humanized. The success of these efforts soon led to many similar establishments, until at present the use of bovine vaccine-virus has very generally superseded that called humanized, both in this country and Europe.

**Symptoms.** — When a small quantity of active vaccine- or cow-pox virus is brought in contact with the cutis vera of an unprotected person by removing a portion of the cuticle, as in the familiar process of vaccination, no appreciable effect is produced until the end of the fourth day. Then, at the point of introduction, will appear a small, hard, elevated papule with a minute vesicle on its apex, very closely resembling the individual papules of variola. The papule continues to enlarge in all directions

for four days, the vesicle becoming first flattened, then indented in its centre, and filled with transparent lymph or virus. During the fifth day inflammation commences, indicated by an areola of redness, swelling, and a slightly turbid appearance of the lymph in the vesicle. The swelling and redness around the pustule continue to increase for three or four days, accompanied by slight symptoms of general fever, when a dark-brown spot appears in the centre of the pustule now fully distended with purulent fluid. From this time all feelings of general fever disappear, the areola of redness and swelling diminishes, and the dry, brown spot increases until the pustule has become replaced by a thick, brown scab, under which cicatrization takes place and the scab falls off, leaving an indented or pitted cicatrix, or scar.

The process of desiccation usually occupies from seven to nine days, making the whole time from the introduction of the virus to the complete cicatrization of the pustule about three weeks. As a rule, in vaccination, papules appear only at the points where the virus has been introduced; but in a very small percentage of cases a few papules have appeared on other parts of the surface. In no case is there developed in the system a contagium sufficient to render the disease contagious or communicable from person to person in any other way than by vaccinating with the virus.

Vaccination-rashes may be divided into two main groups, the first being those that arise from pure vaccine-inoculation. There may be secondary local inoculation of vaccine-eruptions that occur before vesicles form, and eruptions after the formation of vesicles, as well as sequelæ of various forms due to the irritation of vaccination, and usually occurring in predisposed subjects. The second group includes eruptions due to some admixture

with the vaccine-virus, which may be introduced with the virus at the time of vaccination, causing some local disease, such as impetigo contagiosa, or constitutional disease, such as syphilis, leprosy, or tuberculosis; or these may be introduced after the vesicles have developed and ruptured and then cause conditions like erysipelas, cellulitis, gangrene, or pyæmia. In the first group, among eruptions occurring before vesicles form, may be noted vesicular and bullous eruptions and erythema multiforme.

In the next subsection of this group may be noted the frequency of roseola and a measles-like rash and a lichen of various forms that comes out in successive crops. Purpuric rashes may occur in very cachectic children. Eczema may occur, but it should not be attributed to the vaccination unless it appears before this is completely healed. Psoriasis after vaccination is a pure curiosity. The irritation of vaccination is likely to determine the outbreak of the rash of congenital syphilis, and it is absolutely wrong to consider a syphilitic rash due to inoculation at the same time with the vaccine, unless the rash appears only about fifty days subsequent to the inoculation. Tuberculosis has been introduced with vaccine-virus, but this is extremely rare, and cannot occur when glycerinated calf-lymph is used. Robert J. Carter (*Lancet*, Aug. 20, '98).

Tetanus is not a frequent complication of vaccination, a total of 95 cases having been collected. The number of cases recently observed is out of all proportion to what has been observed heretofore. The cases are chiefly American and occur scattered throughout the eastern United States and Canada. They have nothing to do with atmospheric, telluric, or seasonal conditions. They occur in small numbers after the use of various viruses. An overwhelming proportion has occurred after the use of a particular virus. The tetanus organism may be present in the virus in small numbers, being derived from the manure and hay. Occasionally the number of bacilli becomes greater than usual through carelessness or accident. The future avoidance of the complication is

to be sought for in greater care in the preparation of the vaccine-virus. The writer himself contends that vaccination should be carefully done with aseptic precautions; that the after-treatment of the site of the scarification is very important in preventing cellulitis, erysipelas, and tetanus; that vaccination, when carefully done with properly prepared lymph, is a harmless procedure. J. H. McCollom (*Boston Med. and Surg. Jour.*, Aug. 21, 1902).

**Diagnosis.**—The diagnostic features of the true vaccine-sore are seen in its exact similarity to the distinct or separate sore of unmodified variola. It passes through the same stages, in the same order, and in about the same time, but attains a larger size.

**Etiology.**—The cause or causes capable of producing the original cow-pox as a bovine disease are not known with certainty. The close similarity of the sores of cow-pox and variola and the power of the virus of those of the former to render the human subject immune to the contagium of the latter caused many members of the profession to regard the disease in the cow as produced by the variola contagium which in passing through the cow was so modified as to lose its virulence while retaining its immunizing power.

Several experimental investigations have been prosecuted to demonstrate the correctness of this view, but with results sufficiently variable to leave the subject still not settled or free from doubt. Without attempting to decide the question as to the origin or essential cause of the cow-pox disease, we may assume with great positiveness that the lymph or virus from the cow-pox vesicle, if properly used, affords a reliable protection from attacks of variola in all its forms. The questions of great practical importance then are: 1. What is the best method of propagating and preserving



the cow-pox virus in a pure and active condition ready for use? 2. At what age should vaccination be first practiced, and how often should it be repeated to secure reliable immunity from an attack of variola.

In answering the first question it must be admitted that the best method of propagating the virus is from heifer to heifer, in well-arranged establishments conducted with strict regard to sanitary and aseptic precautions, and on heifers in good health. The best time to secure the virus is on the eighth day after vaccination, just before it begins to look turbid in the vesicle. If it is received into sterilized capillary glass tubes and hermetically sealed it will preserve its activity an indefinite period of time and may be transmitted to any country or climate. But for early use it has been found most convenient to receive it dried on ivory points sufficiently sharp to use for incising the cuticle. By dipping the point in clean water and making the incisions to the cutis vera and rubbing the abraded surface with that part of the point covered with the virus and then let it remain uncovered until dry, enough is generally introduced to insure the appearance of the vaccine-sore at the end of four days. It is thought by many that the making of two or three vaccine-sores afforded more perfect immunity than only one.

In order to perform an aseptic vaccination, the child's arm is first sterilized for some distance around the vaccine-site, and, after introducing the lymph, the skin is covered over and around the parts, with hot boric gelatin, which rapidly sets into a transparent film, through which the progress of the vesicles can be observed. On the eighth day the film is quite easily peeled off; the vesicles are then dusted over with boric-acid powder, after which another and thicker layer of the gelatin is applied, and, while setting,

daubed with cotton-wool. Sinclair (Brit. Med. Jour., Jan. 1, '98).

A point on the breast two finger-breadths outside the nipple and two finger-breadths below it recommended for vaccination. It is not subject to much rubbing from the clothing, and inflammation is not likely to occur. Flachs (Deut. med. Woch., Feb. 15, 1900).

The most recent mode of preserving the virus for use which is meeting with favor is called glycerinated lymph put up in sterilized glass tubes, convenient to use instead of the ivory points.

Concerning the second question it may be said, with much confidence, that the most appropriate and effectual times for practicing vaccination are, first, in infancy between the age of six and eighteen months; again when old enough to enter school,—*i.e.*, at the age of seven or eight years; and a third time at the full maturity of growth,—*i.e.*, between twenty-one and twenty-five years of age. If every child were effectually vaccinated with pure vaccine-virus during infancy, again at the commencement of school-age, and a third time in early adult life, in a few years the whole population would be rendered immune and a small-pox epidemic could not occur.

Germany stands alone in fulfilling in great measure the demands of hygiene, having, in consequence of the calamitous small-pox epidemic of 1870-71, enacted the law of 1874, which "makes vaccination obligatory in the first year of life and revaccination also obligatory at the tenth year." The result is that, with a population of 50,000,000, having in 1871 lost 143,000 lives by small-pox she found by her law of 1874 the mortality diminished so rapidly that to-day the disease numbers only 116 victims a year. These cases, moreover, occur almost exclusively in towns on her frontier. If it were true that a good vaccination does not protect from small-pox, we ought to find in small-pox epidemics that the disease diffuses itself in the well-vaccinated no less than in the non-vaccinated countries.

But it is not so. In 1870-71, during the Franco-German war, the two peoples interpenetrated each other, the German having its civil population vaccinated optionally, but its army completely revaccinated, while the French (population and army alike) were vaccinated perfunctorily. Both were attacked by smallpox; but the French army numbered 23,000 deaths by it, while the German army had only 278; and in the same tent, breathing the same air, the French wounded were heavily visited by the disease, while the German wounded, having been revaccinated, had not a single case. Bizzozero (*Med. News*, Dec. 17, '98).

In many cases the immunity conferred by the first effectual vaccination would remain through life, and the subsequent vaccinations would produce no effect. In many other cases, however, the second or third vaccinations would take effect and produce a partial or complete vaccine-sore, thereby showing that the immunity conferred by the first had been more or less impaired and the person again susceptible to variola, but generally in the mild form called varioloid. By the regular repetition of vaccination at or near the times just indicated, the gradual loss of immunity known to take place in many cases after one vaccination is detected and remedied; and the trouble and expense occasioned thereby is so trifling compared with the importance of the object to be accomplished that no person is excusable for neglecting it.

Many of the domestic animals are susceptible to smallpox vaccine. The time of development varies notably, from three days in a guinea-pig to from nine to eleven days in a dog. This variation appears to depend on the resistance of the animal, and apparently does not increase or decrease the virulence of the vaccine. Vaccine grown for seventeen generations on guinea-pigs, where it develops in three to four days, when inoculated on heifers or dogs, takes the usual time for development in those animals.

Vaccinal immunization in cattle is not to any notable extent transmitted to the foetus.

A great many chemicals have a destructive or germicidal action on bacteria, but in the list of chemicals thus far tried, none have been found which show any special or specific action against the vaccine organism. The vaccine organism is not killed by glycerine, chloroform, chloretone, potassium cyanide, carbolic acid, or quinine, when these chemicals are not used in too great strength. At the same time all the ordinary bacteria, contaminating the vaccine, are destroyed.

Contrary to the opinion of many observers, the writer has not found that the vaccine organism decreases in virulence by repeated inoculation on calves. At one time a strain of vaccine was carried through eighteen generations on calves in eighteen weeks, destroying the bacteria in the vaccine with chloretone before making each inoculation. At the end of the time there was no apparent loss of virulence. C. T. McClintock (*Journal American Medical Association*, July 30, 1904).

**Varioloid.**—Within a few years after the general resort to cow-pox vaccination for preventing variola, experience showed that, in a small percentage of those apparently well vaccinated, the immunity to variola was not complete. Such when exposed to the virus or contagium of variola took that disease, but it passed through all its stages in a modified or mild form. Others whose vaccination rendered them wholly immune for six or seven years subsequently became susceptible, generally to the mild form, though in some cases, in which the vaccination was practiced in infancy and not repeated, exposure to variola after the middle period of life has caused severe and even fatal cases of the latter disease. The cases occurring after vaccination are designated varioloid. They are caused solely by variola contagium, and are capable of communicating that



disease in all its forms to any other persons not previously fully protected. Consequently they should be carefully isolated and treated in all respects the same as unmodified cases of the mild or discrete variety of variola; and the same vigilance in their cleansing should be exercised during their convalescence.

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**VASCULAR DISEASES OF THE BRAIN.**—The subjects of CEREBRAL HÆMORRHAGE, ENCEPHALITIS, CEREBRAL ABSCESS, and HYDROCEPHALUS have been already treated, and hence need no further mention.

Cerebral vascular diseases might be considered as to their effects: 1. On the permeability of the vessel-walls. 2. On the vasomotor arrangements for the brain itself. 3. On the brain-tissue involved by vascular obstruction.

The main facts so far known regarding the vascular pathology of the brain hinge on the last one of these points. Hence the best basis for approaching this subject is an outline of the effects produced by blocking of each individual vessel or branch. The causes and consequences will then admit of a more concise and satisfactory handling.

In general, it may be said that the effects are somewhat proportional to the size of the vessel and the suddenness with which the block occurs. Of course, as regards the eventual amount of anatomical damage suddenness has little to do.

The anatomy and nomenclature given in the writer's article on "Vessels of the Brain" in volume viii of the "Reference Hand-book of the Medical Sciences" will here be followed.

#### General Symptomatology.

**ARTERIES.**—(a) *The Dural Arteries.*—For two reasons, obstruction in these

is harmless. In the first place, they do not have to do with the brain proper, but constitute in this particular an independent system. In the second, they are not terminal vessels, but are at all points protected by ample anastomoses.

(b) *The Brain-arteries Proper.*—The main factor here is the fact that, aside from the chief trunks, all the distributing vessels are more or less terminal arteries, and in part strictly so. Consequently the area supplied by any one of them is, in case of closure (embolism, thrombosis, obliterating arteritis, or enduring [?] functional spasm), bound to undergo softening to a corresponding extent—the whole area, if a strictly terminal vessel, and a portion if only partially so.

The true terminal arteries are the perforants at the base and the small branches from the basilar directly entering the pons. But beyond the circle of Willis, all the pial arteries of much size are partially terminal.

**THE INDIVIDUAL ARTERIES AND BRANCHES.**—*Lenticulo-striate Artery (One of the Preperforating from First Part of Sylvian).*—Partial softening in shape of a wedge with its tip in the interior part of the lenticular nucleus, while its base is directed forward and takes in the anterior two-thirds of the striate body. The wedge is formed of the anterior part of caudate, the internal capsule, and the third segment of the lenticular nucleus. Motor paralysis of the opposite side.

*Lenticulo-optic Artery (also from Sylvian).*—Softening of post-external part of lenticular nucleus, of part of internal capsule, of anterior part of thalamus, and of tail of caudate.

*Perforating Arteries from Choroid Plexus.*—Partial softening of thalamus, size of a pea to a filbert.

*Post-external Optic Artery.* — Walnut-sized softening in the subposterior part of thalamus and in the peduncle.

*Precerebral plus Sylvian Artery.* — Block at bifurcation of internal carotid, extending in the precerebral beyond the precommunicans. Softening of frontal, parietal, and sphenoidal lobes, the striate body, etc.: *i.e.*, of the whole territory supplied by both the precerebral and medicerebral arteries. Here we may have opposite hemiplegia; and, if on the side of the speech-centres, “total aphasia, together with an altogether unusual amount of mental degradation, in addition to blindness and loss of smell on the side of the lesion. The extramental degradation would be due to the fact of the cutting off of the blood-supply from the callosum, seeing that this is mainly supplied from the precerebral.”

*Precerebral Artery Alone.* — Softening of the frontal convolutions and of the inner surface of the hemisphere as far as the calloso-marginal fissure.

[In Freitel and Baumgartner's case (Virchow's Archiv, '88) obstruction at the beginning of the precerebral, by cutting off fine branches to the region of the chiasm, produced partial femoral hemianopsia on that side and palsies of eye-muscles. WILLIAM BROWNING.]

*Branches of the Precerebral.* — 1. *Subfrontal Branches.* — Softening of orbital convolutions. No distinguishing symptoms.

2. *Interior Prefrontal Branches.* — Softening of first and of much of second frontal convolutions. Likewise part of so-called “silent” regions of brain.

3. *Posterior Branches* — Softening of remaining median surface of hemisphere supplied by precerebral artery. Crural monoplegia.

(A) *Medicerebral Artery* (in its first two centimetres, from which part are given off the preperforatings above men-

tioned). — Softening of whole territory of Sylvian artery (same parts as in *B*), also motor segment of internal capsule, corpus striatum (thus including lenticular and caudate nuclei), and anterior third of thalamus. The symptomatology is also practically same as in *B*, except— if possible—more pronounced and with deeper mental impairment.

(B) *Sylvian Artery, Beyond the Perforatings, or all its Branches.* — Total softening of cortical territory of Sylvian (*v. infra*: branches). Blocking here causes complete hemiplegia of opposite side (with exception of the trunk and other bilaterally acting muscles) and “total aphasia” if on the side of the speech-centres; “that is, in addition to aphasia proper there would also be agraphia, as well as complete word-deafness and word-blindness, carrying with them that amount of mental degradation which is inseparable from a blotting out of all the word-centres in the leading hemisphere.”

*Cortical Branches of Sylvian Artery.* — The clinical results here vary some according to the slight variation in different individuals in the extent of cortex supplied by this vessel, but even more upon the differences in the freedom of the anastomoses existing between its branches (cortical) and those of the precerebral and post-cerebral.

1. *Subfrontal Branch.* — Softening of part of insula and of the subfrontal (Broca's) convolution. Aphasia if on the left side, without other paralytic complications.

2. *Preparietal Branch.* — Softening of foot of medifrontal and part of precentral convolutions. Agraphia if on the left.

3. *Mediparietal Branch.* — Softening of both central convolutions along the Rolandic fissure, of the anterior portion of the first parietal convolution, and of



the insula. In either of the last (Nos. 2 and 3) there may be aphasia due to cutting off of subcortical tracts, paralysis of face and arm on opposite side, and paresis of opposite lower extremity. Also paralytic agraphia, if on the left. Theoretically, according to Bastian, also loss of muscular sense in the fully paralyzed parts,—though impossible to demonstrate.

4 and 5. *Post-parietal and Temporal Branches*.—Softening of the subparietal and supratemporal convolutions, and of part of the insula. Word-blindness and more or less complete word-deafness.

“It is only on rare occasions that vascular lesions are precisely limited to the seats of particular word-centres. They are much more frequently irregular in their distribution, or multiple, and thus give rise to confused or less typical forms of speech-defect.”

*Post-cerebral Artery*.—More or less softening of the occipital lobe, especially the cortex on its inner and under aspects, including the region of the cuneus, the hippocampal gyrus, and posterior portion of lower temporal convolutions. Hemianopsia of the opposite half of the visual field, with preservation of pupillary reactions from both halves of the retinae.

*Cerebellar Arteries*.—Embolic and thrombotic softening here is more rare.

*Vertebral Arteries*.—Embolisms of the vertebral are more often on the left, due to the existence on that side of a marked constriction where the vessel discharges into the basilar, whereby emboli are caught at that point. Softening may not result. If, however, the block extends any distance along the artery (as is usually the case in thrombosis), softening in the corresponding half of the oblongata may be expected.

*Basilar Artery*.—Blocking of this ves-

sel, usually thrombotic, so long as the post-communicants are patent, only produces symptoms by cutting off the small terminal branches to the pons. These are, however, important, and two types of effect are distinguished according as the block affects the upper or lower portion. Where the focus is at the upper limits of the pons, involving cerebral crus, corpora quadrigemina, and optic tract, there may be a paralysis of the extremities on one side with that of the eye-muscles on the other (hemiplegia alternans superior). Where, however, this affects the pons at the facial-nerve exit, there may be paralysis of extremities on one side with that of the facial on the opposite side (hemiplegia alternans inferior).

### Embolism.

**Definition.**—Embolism of the brain, like that in other parts of the body, is the blocking of an artery by a plug or material sufficiently solid to stop its blood-current. It plays a more important part here because: 1. The arteries are, to a greater extent than in most other parts, terminal vessels. 2. The special functions of any destroyed part of the brain cannot be compensated; as *e.g.*, in the lungs or spleen, where all portions act practically alike.

**Varieties.**—*Transient Embolism*.—In this form the occluding substance breaks up or is floated along to a place where the collaterals suffice, and this happens before death of the threatened tissues. It is believed to explain occasional transient seizures experienced by embolic subjects.

*Simple Embolism*.—The ordinary form, where the floating mass lodges in some artery and cuts off the whole current immediately.

*Septic Embolism*.—Where the embolic plug carries some infecting agent. Inas-

much as an ulcerative endocarditis may be due to the invasion of the ordinary pus-organisms (streptococci and staphylococci), gonococcus, tubercle bacilli, or even certain other micro-organisms, it follows that a plug carried to the brain may be the transporter of infection like that of its source. In such cases the reaction about the point of lodgment or in the involved area will bear some relation to the virulence of the underlying germ.

It is a notable fact that a septic cerebral embolism is far more liable than any other to form the starting-point of a hæmorrhage. It appears to start from the eroded end of the vessel.

Aneurisms of the brain-arteries in children are said to owe their origin to embolic processes.

*Partial Embolism.*—Where the plug, owing to its angular or irregular shape, does not at first completely block the vessel. In such case either it is soon driven along to some point where it does fully occlude the lumen, or a thrombotic deposit soon forms around it and thus completes the closure.

*Symmetrical Embolisms.*—The corresponding vessels on the two sides have, in rare instances, been the seat of embolism (both medicerebrals, in Carrington's case, '84; both the medicerebrals and precerebrals on each side in Eisen-draht's, Med. News, '92).

*Pigment and Granular Emboli.*—The collections of pigment in chronic malaria are well known. Globular hyaline masses have been described by Klebs and by Manasse, and are supposed to be derived from the white corpuscles. So far as concerns chorea, however, clinical and experimental studies have disproved the theory that it is due to multiple small emboli.

*Fat-embolism.*—This affects primarily

the lungs, but in general fat-embolism the brain-arteries may also be invaded. Only in severe cases are serious brain-symptoms produced, and fever (Scriba, '79) does not result.

*Air-embolism.*—The same applies as to fat-embolism. This refers only to cases where the air enters at other points in the body.

There is also the possibility of air entering through the brain-vessels; but this applies not to the arteries, but to the veins and sinuses. In Genzmer's case ('77) air to a fatal extent was aspirated through the opened longitudinal sinus. François-Franck's experiments ('81) appear to show that by way of the vertebral veins air may be taken in through the occipital diploë veins. In the Porter case (reported by the writer, "Veins of Brain," p. 71) there was some evidence that air was introduced into brain-vessels in tetanic convulsions, the wound being across the forehead. Koerner, from a case published by him in '97, concludes that in operations on the lateral sinus, where the sinus-wall shows respiratory movements, the vessel should first be closed below before venturing to open it, lest air be sucked in.

*Symptoms.*—These are largely dropping out of functions (*ausfall symptome*) rather than strictly positive. They are, as a rule, though not invariably, those of a sudden interruption of function of the portion of the brain involved, sudden in onset and promptly complete in effect. Rarely they deepen for hours after the onset. They necessarily vary in intensity and kind according to the extent and location of the area supplied by the vessel. Certain immediate effects may pass off, and some of the more lasting manifestations may gradually ameliorate.

There are no focal premonitions (as headache, dizziness, unilateral tinglings



or numbness about the body, paresis, etc.). And previous headaches, apparently in relation to the trouble, count against embolism. Aphasia speaks in general more for embolism than for hæmorrhage, though common enough in the latter also. Development of the condition during sleep makes the probabilities against embolism.

A history of past rheumatism, especially the presence of a heart-murmur, and still more a knowledge of previous vascular plugging (in any part of the body) are strongly suggestive of embolism. To fully warrant the diagnosis, we must establish the existence of valvular disease or endocarditis at the time of the seizure, though various pulmonary and other conditions may suffice.

The occurrence of apoplexy or hemiplegia in persons under forty years of age has been supposed to indicate embolism, though there are too many exceptions to allow much value to any such age-rule.

The occurrence of coma argues against embolism; at least, embolism limited to the pallium is not attended by this symptom,—and this is its most common location.

The focal symptoms are those of the part involved, and may include almost any loss of function seen in brain disease, though they are more often those of the left side of the brain. For the regional diagnosis (localization) these have been given in brief outline in the schedule of arteries.

**Etiology.**—This has been given in part under the heading VARIETIES.

The forms of verrucous and ulcerative endocarditis, yielding vegetations or other solid fragments that may become freed from their base, are the best-recognized causes of embolism. It has been found that embolism of the brain occurs in 5 per cent. of cases of valvular disease,

and that this occurs twice as frequently in females as in males.

Rheumatism, gonorrhœa, chorea, scarlet fever, and septic processes of all kinds in whatever part of the body, by their tendency to endocarditis, are indirect causes of embolism. Destructive pulmonary processes, pleural irrigation, and entero-peritoneal troubles may start and free thrombi that find lodgment in the brain.

**Pathology.**—The main feature is the softening, and this involves all tissues so far as it goes. It may be red, white, gray, yellow, or brownish, dependent on circumstances, duration, etc. “In the early stages of embolism or thrombosis of vessels supplying the cortex, red or red-and-white softening mixed is found in the area affected; after longer periods yellow softening is met with, or what French writers term *plaques jaunes*; and, after much more prolonged periods, pseudocysts are found, owing to complete atrophy and absorption of the cerebral tissue having taken place.”

It is still an open question whether all focal softening of this type is due to vascular blocking. If so, then in numerous cases either the obstructing material has disappeared or the trouble has been an arterial spasm of sufficient severity and duration to produce the same effect. The left side, and especially the left Sylvian and its branches, is the more frequent site.

**Prognosis.**—Experience shows that the prospect of late improvement after embolism is as good as after cerebral hæmorrhage. In favorable locations a certain amount of collateral compensation occurs, so that a marginal zone of endangered tissue recovers a sufficient degree of supply to resume function. Moreover, many of these are young subjects in whom some substitution of function is

still possible. Immediate danger to life occurs only when the area involved is great, or where essential centres in the pons are included.

**Treatment.**—The treatment of this condition is in most respects the direct opposite of that for cerebral hæmorrhage. Our chief usefulness is at the time of the attack; by immediate and active measures, then, great good can be accomplished.

An ideal method would be the development of a collateral circulation. But the brain-arteries are so largely terminal vessels as to preclude full compensation where an artery of much size is stopped.

Where the blocking is due to atheromatous or other soft material, it may break up sufficiently to pass on. We can only aid this by increasing the blood-pressure and tumbling the plug along.

The most available and useful way for us is to force the embolus as far along into some peripheral vessel as possible. This is accomplished by placing the head low, giving free libations of hot and stimulating drinks, applying bandages to the extremities or abdomen, and the administration of nitroglycerin or amyl-nitrite. Strophanthus may be admissible if the heart is not acting so tumultuously as to possibly tear off another plug.

The patient should be in the fully reclining position, with the head low. All depressants, depletors, and such vascular constrictors as ergot and digitalis should be most scrupulously avoided.

The management of the case after the embolic softening has fully developed is that of hemiplegics in general. We may not remove the focus, but we can look after the general health and do much, by training the patient, to regain the full power that is left.

### **Thrombosis.**

**Definition.**—Under this general head-

ing it is convenient to include the blocking due to specific autochthonic coagulation arterial disease, obliterating endarteritis, etc. To some extent these are distinguishable conditions clinically and therapeutically, yet they have much in common. In this sense it includes all cases where local processes or disease-conditions lead to vascular occlusion and thus to the production of symptoms, if any are present. While there may be a wide difference in the origin of these cases, the final stroke usually depends on a local coagulation or deposit of material from the blood. If the vessel be previously narrowed, then, of course, much less will suffice to block it.

**Varieties.**—There is, in the first place, a wide distinction between arterial and venous thrombosis.

*Arterial.*—This presents several sub-forms:—

1. One is due to conditions of the blood favoring the formation of clot (leucocytosis, increase of coagulation-ferment), as in chlorosis and the puerperium; or to a thickening of the blood and slowing of its current, as in certain diseases attended by debility and exhaustion.

2. Due to trauma, ligature (as in Marchand's case, '94, where fatal thrombosis of the Sylvian artery extended up from a ligation of the carotid), adjacent inflammations, and encroachments or compression, as by neoplasm. The traumatic cause may be either operative or accidental. According to Gerhardt, thrombosis in the branches of the Sylvian artery may occur in tubercular meningitis and thus account for the hemiplegic symptoms in some of those cases.

Otherwise this form is so rare as to merit merely enumeration. The causes of both Form 1 and Form 2 act even



more frequently to produce sinus-thrombosis.

3. That due to syphilitic arteritis. Here the progressive narrowing of the arterial lumen at length reaches such a degree as either to cut off directly the blood-current or to slow it so that coagulation occurs.

4. The atheromatous and allied changes of the arterial wall found in the aged, acting in much the same way as the specific form. The arteriosclerosis of nephritis might be supposed to favor thrombosis, but the accompanying increase in blood-pressure serves largely to prevent this; hæmorrhage is the far more frequent result. Gout and rheumatism are favoring antecedents.

**Symptoms.**—In general, these are gradual in onset and for a time progressive in character. In contrast to this is the fact that there are no prodromata in embolism and at least much less tendency to them in hæmorrhage. The age, general condition, and personal history of the patient give us all-important aids to diagnosis.

Loss of consciousness is not the rule in thrombosis, or not until the condition is so far advanced as to approach a fatal ending. There is a tendency to a slowing of the pulse. It may still vary considerably from time to time, and may increase, of course, if there is any complicating sepsis. This slowing occurs, no matter what part of the brain is especially involved, though, doubtless, it is more pronounced when the basilar is the seat,—and there is a possibility that in all cases where present it is due to participation of that vessel.

Fever is not an accompaniment of the thrombotic process in itself, and occurs only secondary to some outside inflammation or to septic disintegration of the thrombus itself. Barring sepsis, there is,

on the contrary, an inclination to sub-normal temperature, though this feature will take an irregular course. “Yawning, and especially sighing, at times in respiration are frequent and noticeable symptoms in thrombosis and its precedent conditions, though also common in advanced cerebral hæmorrhage.”

The fact that compression of the carotids may aggravate existing symptoms and even bring on slight convulsions in persons suffering from impairment of the brain-circulation, especially thrombotic plugging of the basilar (Griesinger's syndrome), has suggested it as an expedient in the diagnosis of thrombosis. But as it affects disadvantageously the patient's cerebral condition, and possibly involves injury to an old person's carotids, it is generally discountenanced.

Occasionally, in persons of some intellectuality, it is quite possible to locate the trouble in the field of one or more arteries, preferably the Sylvian or its branches (for which purpose compare the schedule of arteries above given).

In the autochthonic form (due to over-coagulability of the blood, retardation of the current, etc.) there may be no distinct forerunners, but only a progressive increase in symptoms and severity. This developmental stage may be very short if the process is limited to a single vessel, or may steadily increase to a fatal termination if it extends to other vessels, for the conditions which started the process may continue to extend it. “Aphasic and amnesic defects of speech have been met with occasionally during or after acute specific diseases, or during the puerperal state; and in all such cases a thrombosis partial or complete of the left cerebral artery is the most common cause” (Gerhardt), though the same causes may favor embolism.

In the other two chief forms we have

a history of past syphilis or a senile subject usually advanced in years to give us a distinct clue. Here prolonged and wavering prodromata, especially if diffuse or scattering and not focal, strongly suggest thrombosis. There are frequently such warnings and forerunners of various kinds. Transitory paræsthesiæ (tinglings, numbness, etc.), pareses, aphasic spells, twitchings, headaches, visual obscurations, cardiac and respiratory irregularities, lapses of memory, mental hebetude, dizziness, etc., according to the location and extent of the threatened area, are more or less frequent. If unilateral in type, they are the more in evidence. These, at times, last over a period of weeks or months, but often are of a few days' or less duration. "The physiologically-recurring waves of vessel-contraction and diurnal or other periods of fall in blood-pressure, added to the pathological narrowing of the vessel (where there is danger of thrombosis) may evidently, for a time, limit the nourishment of the respective area sufficiently to impair its function without actually causing necrosis. The tissues are still supplied with enough to keep them alive, and as soon as the flow again increases these resume their functions. Presently, however, if relief is not obtained, the matter goes too far, and irreparable softening ensues." In some of these cases conditions of astasia-abasia, dyslexia, etc., are noticeable. In reading, writing, muscular or other effort there is a quick tiring of function. "The centres act normally for a brief period, then fag out." This may apply to large areas or almost the whole brain, again is more one-sided or even further limited.

Some authorities claim that the specific form is usually limited to a single vessel or a few branches, and hence is focal in character, but to this there are

certainly many exceptions. In the senile type, however, the process is widely distributed, and hence the manifestations are more general and diffuse. This applies more especially to the prodromata and general features than to the symptoms following the softening,—which latter necessarily represent one or more distinct foci.

"In the specific form, which may occur at almost any period of life, there may, or oftener may not, be much headache; if especially nocturnal, so much the more in evidence." Ophthalmologists recognize a chorioretinitis syphilitica as analogous to specific diseases of the brain-arteries. In suspected cases lacking a definite history of syphilis, a careful search must be made for any marks about the body or other indications pointing or not to that diagnosis.

**Etiology.** — Certain general influences play a secondary rôle. All debilitating and wasting diseases, by weakening the circulatory force and by reduction of the traversing fluid, have such a tendency. Excessively warm weather, a rapid rise in the atmospheric temperature, and marked fall of the barometric pressure favor the occurrence of thrombosis, while opposed to cerebral hæmorrhage. Senility also acts in the same sense, as well as in a more direct manner.

The more immediate causes fall under two heads:—

1. Local disease of the vessel-walls. Atheroma, pre-eminently a disease of the old and favored by chronic alcoholism, occupies a prominent place here. It narrows the lumen of the vessel, but may also be the object around which the thrombus starts. Syphilis acts essentially by thickening of the arterial wall (endarteritis syphilitica, periarteritis nodosa, etc.); it is said to cause thrombosis



chiefly in those between twenty and fifty years of age.

Sometimes the thrombosis starts in an aneurismatically-dilated artery.

2. It may be due to a strong tendency of the blood to clot (leucocytosis often present). This is a much less frequent cause. Gout, chlorosis, and especially the puerperium (when the vessels of the uterus have to be closed by clot) here play a rôle. In such case a practically spontaneous coagulation occurs and obstructs an otherwise healthy vessel.

**Pathology.**—This is, from a practical stand-point, simple, and corresponds closely to that of embolism. Inasmuch, however, as the remaining vessels are so often more or less similarly diseased in the common forms, the chances of establishing an adequate collateral circulation are not as favorable. Consequently the area of softening, for any given vessel, is rather larger. So soon as the current has been entirely cut off for a short time, a few hours or probably less, necrosis is established and the part thus affected is hopelessly lost. The later course of such a focus is the same as that after embolism.

**Prognosis.**—This has reference to three points:—

1. The prodromal stage. Where it is possible to make the diagnosis and institute treatment at this stage, softening can usually be headed off. This is quite intelligible in syphilis, though there is a great tendency to recurrence. And even if the specific process is absorbed, there remains ever after a weak spot in the arterial parietes that may under strain give way and be the source of a hæmorrhage. The senile gouty and atheromatous forms are also amenable, and not infrequently seem to recover permanently. Of course, in that happy event it is not to be supposed that the artery-wall is re-

juvenated, but only that things have so adjusted themselves that there are no longer active manifestations.

2. The thrombotic softening. This in itself is, as above stated, somewhat less favorable than in embolism. The tissue-loss is permanent, and function can be compensated only to a degree.

3. The tendency of the process to extend. It is difficult to be very explicit on this point. In many cases there is reason to think that numerous vessels are more or less affected by the same process and that the same dyscrasic cause continues, only that it reaches extremes in but one or two at a time. Unless very carefully managed, we may expect that sooner or later the danger-limit will be reached in some of these.

**Treatment.**—To be successful this must be prophylactic and directed to the prodromal stage. The trouble is of slower development than hæmorrhage or embolism, and needs be met with less vigor, but more persistence and greater skill in adaptation of means to an end. There is one danger in the measures for relief; we are dealing with diseased vessels, their walls being often much weakened; there is no such disturbing fear in embolism, for there the vessels are presumably healthy; nor in hæmorrhage, for there our efforts at relief involve no strain on the vessels.

When we find signs of such danger impending, the first or immediate line of treatment is analogous to that in embolism, though there is less need of increasing the body-fluids. The vessels must be dilated to allow the blood to pass, and the pressure should be increased to get it through. Here, again, the nitrites are as yet our main stay, sometimes reinforced by strophanthus and strychnine. We desire the slow, continuous-acting nitrites; Bradbury ('95) found experimentally

that there was a difference in this respect. In the practical use of the nitrites, however, there is one point not duly appreciated. From nitroglycerin we rarely get any stomach disturbance; but from nitrite of sodium and unfortunately also from erythrol-tetranitrate there is very often complaint of much discomfort about the region of the stomach, and it is the same in whatever way administered. The objection to these latter remedies is time and again so great that they have to be discontinued. Still, even then we can fall back on the nitroglycerin and succeed fairly well.

Avoid digitalis and everything causing arterial contraction.

As soon as immediate relief is secured a course must be adopted looking to more lasting benefit.

For atheroma, small, long-continued doses of iodide of potassium are much used; for one reason or another (slow action, the occurrence of iodism, etc.) it has rarely given much satisfaction in my experience.

The nitrites should be accompanied or followed by brucia (in doses of  $\frac{1}{20}$  to  $\frac{1}{10}$  grain) or its allies in stout doses, and persisted in for months with more or less regularity according to immediate needs at any time.

Another useful line of remedies depends upon the fact that most of the old patients are rheumatic, gouty, or sufferers from what might be termed senile lithæmia. Physical inactivity plays a part. Waste and refuse products of the system are not eliminated with due promptness and aggravate the atheromatous trouble.

Here alkalies and antilithic remedies have to be employed. Much aid is furnished by certain of the sulphur-waters. If it is possible for the patient to visit the springs, so much the better; otherwise

the waters may be employed at home. A course of these waters can be repeated from time to time.

In the syphilitic form the whole power of our therapeutic resources should be promptly brought to bear and continued until all symptoms are well in hand. It should be borne in mind that often the so-called specifics will develop this desired local action only after the vessels have been dilated. So long as they are almost closed, it is evident that little blood, and consequently little of the medicament, can reach the imperiled point. It is necessary, if possible, to open the vessel-path, and, while keeping the way open, follow up with the more direct specifics.

#### **Thrombosis of the Brain-veins and Sinuses.**

**VEINS.**—Primary thrombosis of brain-veins has been but rarely observed. Hence, despite the occasional description of cases in the literature, it is impossible to present anything very systematic in regard to the matter.

Without doubt it is of greater frequency than appears from the above. The reason why it is not more recognized is that in itself it but very exceptionally causes symptoms. All the pial veins have numerous and free anastomoses, so that serious stasis only results when whole net-works of contiguous veins are filled. In the latter event, softening of the corresponding drainage-area has been noted. In such a case a focal diagnosis is the most that one might expect to make. If other manifestations are present, they are usually due, as in sinus trouble, to sepsis rather than the thrombosis as such.

The question of terminal veins in the brain is not fully decided, though only as regards the perforatings, the prefontal efferents, and parts of the internal or Galen's system: the same parts, it may



be remarked, where the arteries are strictly terminal. The balance of evidence favors the view that in these limited sections there are at least many connections between the finer branches. The practical facts as regards Galen's system will, however, be summarized in discussing the straight sinus.

More often there is a secondary venous thrombosis here, an extension backward of a like process in the sinus into which the vein empties.

Cretefaction and fatty degeneration of the parietes of these vessels also occurs, though, of course, without clinical significance. And the same applies to the endophlebitis deformans chronica described by Huber.

*Sinus-thrombosis.*—This is a blocking of any one or more of the several venous sinuses of the brain.

Such obstruction is, of course, never of embolic origin, but always due to thrombosis (or, in rare cases, to trauma or ligature). Neighboring septic trouble is more often a cause than in the case of the arteries, but otherwise disease of the vascular wall plays no such part as with the arteries. The causes are, however, many. In children it occurs in marasmus, cholera infantum, whooping-cough, and other conditions of extreme exhaustion. In the adult, chlorosis, pregnancy and the puerperium, erysipelas (by extension, centrally, of a process starting at the surface), cholera, and like disorders that greatly reduce the body-fluids, septic processes in adjacent tissues, and any form of debility that greatly weakens the circulation. Most frequent of all are the cases of phlebitis of the lateral petrous and connecting sinuses, due to extension of inflammation from ear disease; the important features of this form belong to the ear section.

There are other less frequent forms of

inflammation, starting, perhaps, in the parasinual spaces and involving the sinuses.

*Symptoms.*—It should be remembered that one or both jugulars may be tied, one or even both lateral sinuses closed, or almost any single sinus blocked, without the necessary production of symptoms, as has been many times shown by clinical, operative, and, in animals, experimental evidence. The only exception to this is the straight and possibly the two cavernous sinuses. In the very young, the feeble, or those otherwise exhausted, blocking of a sinus may have more effect, and be a factor in a general break-up. Such was, perhaps, the explanation in Kummer's case (Rev. de Méd., '99), where a fatal result followed ligation of one internal jugular, some hyperæmia and hæmorrhage being found in the brain.

The sinuses that are easy of access surgically are the longitudinal and the two laterals. Besides these, if it were warrantable, it would be quite possible to tie the end of a straight sinus.

Thrombosis of the brain does not lead to any definite increase of the cerebrospinal fluid, as a rule. The only exception is where the outflow through the straight sinus is interfered with, or, possibly, the venous discharge from the small fringe of choroid plexus in the angles of the fourth ventricle.

*For the most part, the symptoms attributed to sinus-thrombosis are really due to the attendant sepsis or an extension of the inflammation to neighboring structures.* Consequently it is only incumbent here to consider the cases where positive symptoms are due to the blocking as such.

It is claimed by Voss ('99) that a murmur can be detected in the unobstructed internal jugular vein, or that it can be

produced artificially by a slight pressure of the stethoscope on the neck close to the base of the skull. If, however, the murmur is absent despite such reinforcement, while present on the other side, there must be occlusion of the sinus.

The presence or absence of a sinus pulse has no diagnostic value as regards thrombosis (Preysing, '98).

The untoward effects of closure of the straight sinus have been recently studied by the writer ("Normal and Pathological Circulation in the Central Nervous System," '97, pp. 68 and 83), and the following conclusions (pp. 90-93) drawn:—

"In cases of closure of the sinus rectus, Galen's vein, or the velar veins, three possible outcomes are to be thought of:—

"1. Full physiological compensation. There appears to be no evidence to show that perfect compensation can occur.

"2. An increase of ventricular fluid, leading to hydrocephalus.

"The ample anastomoses described, and the fact that normally this venous current has to turn several sharp angles before leaving the skull, make it, at first, unintelligible why there should ever be any trouble following the closure of the sinus rectus or its practical extension, the single trunk of Galen's vein. And, *so far as concerns either the vitality of the tissues or the function of the brain-substance and nerve-substance proper, there is nothing to show that compensation is less perfect than where other brain-veins are closed.*

"The difference depends entirely on the presence, in the territory of this vein, of a peculiar structure, the choroidal tissue, occurring only in the brain-ventricles. This tissue normally produces ventricular fluid. Its activity is easily influenced by many conditions, and it responds quite naturally to any interfer-

ence with the venous discharge by an increased production of fluid.

"It is, then, not primarily any venous stasis that causes symptoms, but only the secondary hydrocephalus. And the facts show that this is always bound to occur. This causes death, if at all, only after a lengthy period and in this indirect manner.

"3. Early death.

"If, however, the velars be closed (*i.e.*, the *venæ intimæ* be cut off from both their regular and collateral outlets), then, so far as present evidence goes, a speedy fatal ending is inevitable. This takes place before there is time for the development of much hydrocephalus, a small quantity of blood-tinged fluid being all that has accumulated.

"Up to 1884 the writer was able to collect three such American cases, and those from foreign sources were merely corroborative.

"It is still possible that if only the main trunk of one or both velars was obstructed, and the thrombus did not extend into any of their branches, the fatal ending might be delayed, but hardly for long."

CAVERNOUS SINUSES.—In some cases simple blocking of a cavernous sinus may not cause marked symptoms. It depends upon how much of a *confluens* it happens to be in the individual case. Even when it receives a large basilar and a deep Sylvian branch, it is probable that other venous channels can re-establish an outlet and softening be avoided. The most definite symptoms are on the orbital side. There may be puffiness about the orbit, some distension of the veins in the same region, and even prominence of that eyeball or more lasting interference with the vision and nutrition of that eye. But all such manifestations are far more marked in septic than in simple thrombosis.



**Treatment.**—Where the thrombus is of septic origin or has become infected, surgical treatment is called for, the same as in any other part of the body. There is no safety or recovery until the material is removed. In cases of simple or uncomplicated thrombosis, on the other hand, direct interference is not called for; prophylaxis, if anything, is the *desideratum*.

WILLIAM BROWNING,  
Brooklyn.

## VASCULAR SYSTEM, DISEASES OF. Arteries, Disorders of.

### Arteriosclerosis (Arteriofibrosis; Atheroma).

**Definition.** — Arteriosclerosis is characterized by thickening of the walls of the arteries, due to morbid changes in the intima and giving rise to localized or general narrowing of their lumen.

Three varieties of arteriosclerosis may be recognized: the *nodular*, in which the morbid changes are localized, though widely disseminated; the *senile* form, which may be localized or general, and is a manifestation of physical degeneration attending old age; and the *general* form, which may occur during middle age or even youth, through inherited predilection or as a result of various etiological factors.

**Symptoms.**—These depend to a great degree upon the regions which have become the seat of the morbid changes. As a rule, a high-tension pulse is indicative of arteriosclerosis; but this is not invariably the case, as high tension may exist with little or no sclerotic change. The vessel-wall is hard, and it is often difficult to obliterate the pulse even upon firm pressure. Sphygmographic tracings show a short, sloping upstroke, a wide top, and a slow, gradual downstroke. The left ventricle becomes

hypertrophied as a result of peripheral resistance. In advanced cases the apex-beat is displaced and the second sound is accentuated and ringing in character. Subjective symptoms may be absent for a variable period until the heart, kidneys, lungs, or brain call attention to the disease. Following the cardiac hypertrophy may be cardiac dilatation, with symptoms of valvular insufficiency. Dyspnœa, palpitation, and initial murmur are prominent. Angina pectoris may also be noted as a complication.

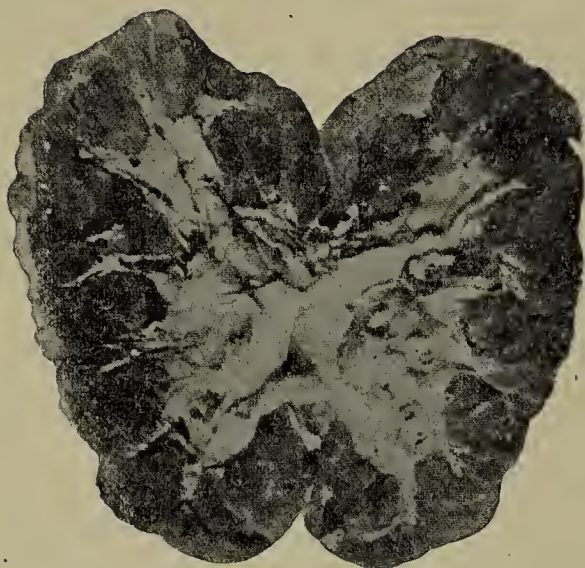
When the arteries of the kidney are especially affected, this organ atrophies from want of sufficient blood-supply, and the symptoms are the same as those of the atrophic form of nephritis. The amount of albumin may be small and casts few.

The cerebral symptoms may consist of persistent headache, vertigo, hæmorrhage, aphasia, transient hemiplegia, and other palsies. The arcus senilis is commonly observed in cases of arteriosclerosis.

Embolus is infrequent, and is usually secondary to the cardiac complications. Spasm of the arteries, including the coronary, is thought to occur often and to account for the attacks of angina pectoris occasionally observed. The heart's rhythm and regularity are usually impaired in such cases, and the pulse may differ on the two sides. Rupture of the cardiac wall into the pericardium and death may occur during one of these seizures.

**Diagnosis.** — E. N. Whittier (Boston Med. and Surg. Jour., Dec. 1, '96) alludes to two periods in this disorder which are pregnant with errors in diagnosis. In the first, there is poverty of symptoms by which localization may be accurately mapped out; in the second, such profusion of rational and physical signs,

such evidences of structural changes,—cardiac, renal, and cerebral,—that the underlying and causal relation of the condition of the vascular channels may be altogether lost sight of in the study of the effects of the arteriosclerosis. Sphygmographic tracings, as aids in the diagnosis of disorders of the circulatory appa-



Cut surface of an arteriosclerotic, contracted kidney. (*Bondurant.*)  
(*International Medical Magazine.*)

ratus, are important. Whittier found in all tracings of radial sclerosis evidence of cardiac involvement in the sharp rise, in the lessening of the primary wave, in the lifting of the tidal wave, in the lowering of the aortic notch, and in a flattening of the curves and shortening of the diastolic portion of the tracing.

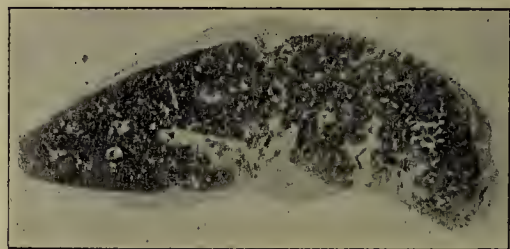
Careful attention to the history of the patient with particular reference to the etiological influence of the chronic intoxications arising from alcohol, syphilis, lead, rheumatism, malaria, etc., will give the largest opportunity for correct treatment during the primary stages, and far in advance of the time when the disease is confessedly unmanageable by reason of the secondary complications—cardiac, vasorenal, or cerebral.

The diagnosis may be facilitated by examining the extremities by means of

the Roentgen rays, as shown by the annexed illustration, which represents a sciagraph obtained by Carl Beck in the case of a Cuban, 68 years of age, whose forearm is taken in pronation, the palm resting on the photographic plate. The radial artery can be recognized just below the bifurcation of the brachial artery, passing along the radial side of the forearm to the wrist, and winding around the outer side of the carpus. Particularly interesting is the grading of the shadow according to the degree of calcification of the artery.

The main general diagnostic points are: increased arterial tension in association with hard arteries, hypertrophied left ventricle, and accentuated second sound.

A new diagnostic sign: In normal adults the heart-sounds are to be heard by careful auscultation over the descending aorta, and in health and under the age of forty to fifty years are most plainly appreciable at a point on a level with the spine of the scapula and just to the left of the vertebral column. With advancing years this point moves downward, and, in addition, there is



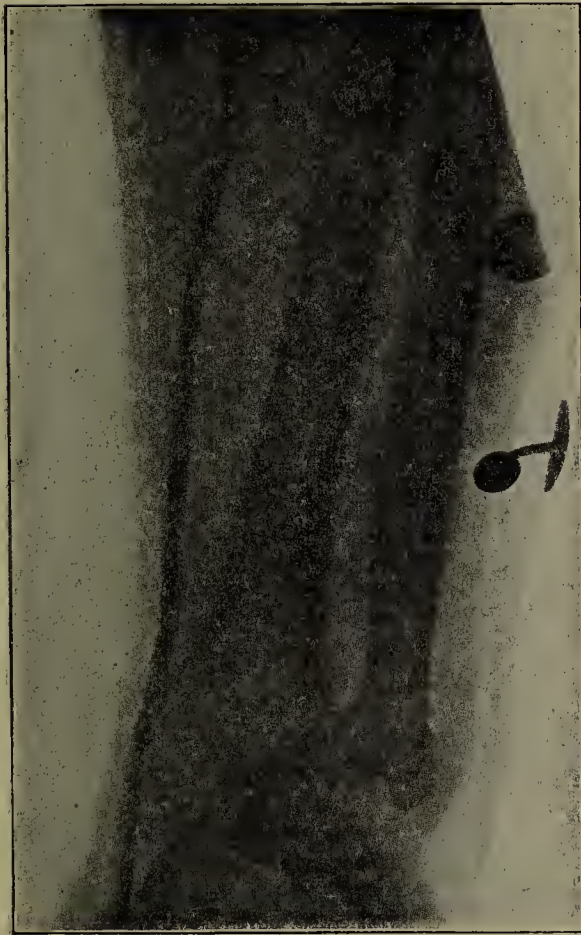
Cut surface of an arteriosclerotic, contracted spleen. (*Bondurant.*)  
(*International Medical Magazine.*)

atheroma of the aorta; the sounds are then to be heard with great distinctness and force on a line joining the angle of the scapula to the spinous process of the seventh vertebra. Friedmann (*Wiener klin. Woch.*, June 21, 1900).

The important part played by arterial degeneration in determining cerebral disorders in later life has led Dr. Adolf Meyer, of New York, Director of the



State Pathological Institute, to inquire into the connection, if any, between the arteriosclerosis and mental disease. He concludes that mental disease is not so frequently due to arteriosclerosis as is commonly believed. Observations on the heart and aorta of the insane showed that arteriosclerosis was exceedingly frequent, but mental disorder could be ascribed to such a morbid process only when it affected the blood-vessels of the



Diagnosis of arteriosclerosis by Roentgen rays. (Beck.)

(New York Medical Journal.)

brain. In many cases of advanced chronic insanity or dementia such a condition undoubtedly existed. The progress of arteriosclerosis in the brain was associated with loss of memory of the immediate past and attacks of mental confusion and transitory delirium. Such demented were found to be liable to indulge in petty larceny and sexual misconduct, and they were frequently guilty of attempts to set fire to houses. Mental disease occurring in that period of

life when arteriosclerosis was most common showed, adds Dr. Meyer, no peculiarity in its nature and course that could not be fairly accounted for by the commencing cerebral decadence of later life, which was a prominent feature especially in neurotic subjects. Both senile and presenile decay of brain-power was associated with arteriosclerosis, but no special arteriosclerotic insanity could be said to exist. When arteriosclerosis was associated with insanity the prognosis was naturally more serious, as there was no special treatment for such a diseased condition of the arteries of the brain. Editorial (*Lancet*, Feb. 28, 1903).

The movability of the apex beat offers a symptom of importance hitherto not described in the diagnosis of sclerosis of the root of the aorta. Normally the impulse lies in the fifth space, between the mammillary and parasternal lines, and migrates, in the left lateral decubitus, to a position midway between the anterior axillary line and the mammillary. Its displacement is about 3 centimetres. In sclerosis of the root of the aorta, this displacement may amount to 4 to 5 centimetres, and the impulse may appear in the axillary line beyond. The phenomenon is due to the fixation of the base of the heart, as a pivot, a firm center, around which the heart swings, and, secondly, to the elongation of the heart which expresses the hypertrophy of the left ventricle. No other pathological condition presents this symptom in equal degree. In the "nervous heart" of the young there is, indeed, a somewhat increased displacement, but it is far less in degree. On the other hand, advanced cases of tuberculosis or marasmus also present the phenomenon, owing probably to the decreased resistance of the lungs, but here also there is no possibility of confusing the conditions. S. Miraglia (*Proceedings International Medical Congress; Medical News*, May 23, 1903).

Among the symptoms that are likely to attract attention, the following will usually be found: Reduced vitality. Many cases of neurasthenia are of cardiovascular origin. The arterio-

sclerotic facies. This consists of a peculiar pallor specially conspicuous around the mouth, temples, and eyes. A change in the activity of the sweat glands. Late in the disease there is dryness of the skin, but early there may be hypersecretion. Renal activity is altered. The urine is more abundant, and is apt to have a variable specific gravity. Later in the disease there is usually albuminuria, at times intermittent, and later still, casts will make their appearance. The early heart symptoms may be vague. Arrhythmia in persons near 40 is too often attributed to gastric disturbances, tobacco, tea, coffee, etc. When the disease is well advanced the heart signs may be quite definite. Ophthalmoscopic diagnosis may at times be possible. Thickening of the retinal arteries is evidenced by the high light of the arterial image and the compression of the veins where the arteries cross them. Attention has been called to these conditions by de Schweinitz, and in a number of personal cases these ophthalmic peculiarities were found very early in the course of the disease. Stengel (American Medicine, Jan. 2, 1904).

**Etiology.**—Arteriosclerosis is generally a disease of advanced life, but it is not infrequently found in middle-aged or even young subjects. Heredity probably plays an important part in the latter case. Males are affected more often than females. Alcohol, lead, rheumatism, gout, malaria, and syphilis are predisposing causes of this disease. Overwork of the muscles, overeating, and drinking to excess are considered by some as leading to sclerosis. Although nephritis may be caused by sclerotic vessels, it is also a means in producing this condition in some cases.

**Pathology.**—Arteriosclerosis affects most often the aorta and coronary arteries, but may be found in almost any part of the arterial system, although it is rare in the hepatic, gastric, and mesenteric arteries. There are two varieties: the *circumscribed* and *diffuse*.

The heart is the organ mainly affected. There are three forms: Syphilitic sclerosis attacks the large and medium-sized arteries; sclerosis of the type of granular atrophy,—an affection of the small arteries and capillaries; the sclerosis of old age,—a general affection of the large and medium-sized arteries. J. W. Runeberg (Finska Lakaresällsk. Handlingar, July and Aug., 1900).

**CIRCUMSCRIBED VARIETY.**—In this form there first appear grayish swellings but slightly raised above the surface, the favorite places being in the arch of the aorta and at the origin of branches. Soon fatty degeneration and necrosis occur and the patch becomes yellowish and soft, thus forming the atheromatous abscess which consists of fat-corpuses, cholesterin crystals, and granular *débris*. As a result of this softening the inner coat often gives way and allows this material to pass into the blood-current. In other cases, however, the atheromatous abscess may heal, leaving only a scar to mark its position, or it may become calcified.

The primary changes of this condition are to be found in the media and adventitia. They consist of local infiltrations around the vasa vasorum and form spots of lessened resistance in these two coats. The intima then becomes affected, and proliferative changes occur, which finally end in the formation of what is known as the atheromatous button. Thoma considers that this increased thickness of the inner coat occurs as a compensation for the growing weakness of the outer ones.

**DIFFUSE VARIETY.**—Most of the arterial system is affected by this form, which is often accompanied by the circumscribed variety in the aorta. The walls become thickened, this being due usually to the great increase in the intima. The media is often found to be hyaline or necrotic; calcareous deposits are also noted, especially in senile arteriosclero-



sis, and in some arteries there is almost complete disappearance of the muscle-fibres. Hypertrophy of the heart is common, and when the coronary arteries are affected myocarditis is also present. Although macroscopical changes in the kidney may be scarcely noticeable, microscopical examination reveals the sclerotic processes.

Regarding cardiac hypertrophy in arteriosclerosis, Hasenfeld (*Deut. Archiv f. klin. Med.*, B. 59, '98) has recently shown that, even physiologically, the splenic, hepatic, and superior mesenteric arteries have a small amount of connective tissue in the intima. Arteriosclerosis of mild or moderate degree, only microscopical, is quite common in the splanchnic arteries, but marked sclerotic changes are much less common than in the aorta, the arteries of the extremities, and the brain. Sclerosis is usually most marked on the main trunks of the splanchnics, and becomes less in the branches. Arteriosclerosis only leads to hypertrophy of the left ventricle when the splanchnics or the thoracic aorta are severely affected. Arteriosclerosis of the other vessels does not seem to have such an effect. In five cases of contracted kidney examined all the chambers of the heart were hypertrophied. If at the same time there was marked sclerosis of the splanchnics, the hypertrophy was most marked in the left ventricle. Extreme sclerosis of the aorta would probably have the same effect. Should further examinations confirm the results now given as regards the uniform hypertrophy of all parts of the heart, we must conclude that the cause of hypertrophy in contracted kidney increases the work of both sides of the heart and probably excites the heart to increased activity.

As the result of an analysis of the records of nearly 4000 patients entering consecutively the medical wards of the

Johns Hopkins Hospital, the authors find the following:—

The percentage of palpable radial arteries is materially higher among those individuals in whom there is a history of heavy physical labor and of the use of alcoholic stimulants than in the remaining cases. This percentage is appreciably higher in the cases giving a history of heavy work.

The percentage of palpable radial arteries is higher among those cases presenting a history of severe infectious diseases than among those in which this history is absent, or among those in which a history of no causal factor could be obtained. The proportion is, however, far below that in the case of work or alcohol.

Rheumatism appears to be the acute infection after which the percentage of palpable vessels is highest, and next to rheumatism, typhoid fever, W. S. Thayer and C. E. Brush (*Journal American Medical Association*, Sept. 10, 1904).

**Treatment.**—A quiet, well-regulated life should be observed, excesses in eating, drinking, or of any kind are to be avoided, especially indulgence in alcohol. The skin should be kept in good condition by frequent bathing, and constipation and any urinary disorders should be promptly attended to. A syphilitic history calls for the use of the iodides. Potassium iodide in doses of from 10 to 20 grains three times daily over an extended period may also be given to advantage in most cases. The nitrites, especially nitroglycerin, are to be used for the high arterial tension. Gourçon advises that in later stages the iodide of sodium be given during twenty days of the month and that on the remaining days nitroglycerin be used. The latter remedy must be given in small quantities, however, not more than 1 minim of a 1-per-cent. solution at first.

Rumpf (*Berl. klin. Woch.*, '97), considering that in arteriosclerosis salts of lime are deposited in the altered wall of

the vessel, recommends (1) to diminish the quantity of lime salts taken with food and (2) to try and decalcify the arteries. He therefore recommends a diet which does not contain milk. The diet should consist of meat, 250 grammes; potatoes, 100 grammes; bread, 100 grammes; fruit, 100 grammes; fish, 100 grammes; along with butter and sugar, and instead of fruit the patient may take vegetables. Besides the abstention from milk, the patient is not allowed to eat cheese, eggs, rice, or spinach. The diet Rumpf recommends contains ten times less lime salts than milk diet. Distilled or boiled water only is allowed as beverage. To increase the elimination of lime salts Rumpf recommends lactic acid (sodæ bicarbonatis, 10 grammes; acidi lactici, q. s. ad saturat. aq. destill. 200 grammes). A similar effect may be produced by calomel, acetate of potash, oxalic acid, and many diuretics.

Regarding the use of baths and gymnastics in arteriosclerosis J. Groedel, of Bad-Nauheim, who has given special attention to the treatment of arteriosclerosis, contends that, although the increased blood-pressure, "considered as the usual consequence of treatment by the Nauheim baths, may, at first sight, seem to indicate that every patient with arteriosclerosis should be excluded from a treatment by baths, a further increase of the high blood-pressure usually found in arteriosclerosis must not only surcharge the heart more than is already the case, but also create the danger of the bursting of a cerebral aneurism, so often present in cases of arteriosclerosis." He has by numerous observations been able to convince himself that baths can be prescribed for these patients "in such a manner that the increase of blood-pressure does not take place, or only in a very slight degree." If the temperature

be kept almost at the point of "indifference,"—that is, about 92° to 93° F. (33.2° to 33.8° C.),—the primary acute increase of blood-pressure caused by the contraction of the cutaneous vessels, and most to be feared, will be very slight, and if there be carbonic acid in the bath at the same time will quickly disappear. If the skin of the patient be cooled somewhat by moistening the parts particularly sensitive to cold before entering the bath, the avoidance of that primary increase of blood-pressure, or, indeed, any shock whatever, will be the more certain. A similarly good effect is produced when the patient is only allowed to take half-baths and the exposed parts of the body are wrapped up so as to prevent cooling. In most cases the amount of water can be increased little by little at each bath until a full bath is at length attained, but even then it is advisable to let the patient only submerge his body by degrees. Placing cold bandages on the bather's head is often indicated. By proceeding cautiously in this manner he has never had an unfortunate case in the course of a practice of twenty-two years in Nauheim. Under what conditions can a course of baths be indicated or beneficial in cases of arteriosclerosis? It may be desirable to give baths for some other disease when arteriosclerosis is present. It is mostly a question of diseases based on the same etiological principle as arteriosclerosis itself, or such as usually lead to it. By combating these we can at the same time retard the progress of the sclerotic process in the vessels.

The influence of high altitudes for patients affected with arteriosclerosis is of great practical interest. Zangger, who recently (*Lancet*, June 19, '99) studied this question, states that if an altitude of from 4000 to 5000 feet above sea-level puts a certain amount of strain on a nor-



mal heart and by the rise of the blood-pressure indirectly also on the small peripheral arteries, this action must necessarily be multiplied in the case of a heart suffering from even an early stage of myocarditis or in the case of arteries with thickened or even calcified walls. It is especially the rapidity of the change from one altitude to another with differences of from 3000 to 4000 feet which must be considered. There is a call made on the contractility of the small arteries, on the one hand, and on the amount of muscular force of the heart, on the other, and if the structures in question cannot respond to this call rupture of an artery or dilatation of the heart may ensue. Patients between the ages of 45 and 70 years who are the subjects of arteriosclerosis can often stand altitudes of 4000 feet and higher; this depends on the degree of the sclerotic process and especially on the localization, though patients in advanced stages all do better at altitudes of not over 3000 feet, and the reason is fairly simple. Take Engelberg, for instance, which corresponds with this height; it is obvious that the patient will want to go for walks and that not only on level paths. He will soon get to altitudes of from 4000 to 5000, even if warned to keep from climbing; if sent to a place already 4000 feet high he will take walks up to 5000 and 6000 and damage may ensue.

Patients with arteriosclerosis should not attempt a residence at a high altitude without medical advice. In any case the patient should take medical advice if symptoms show themselves, such as sleeplessness, dyspepsia, giddiness, buzzing in the ears, palpitation, paræsthesia, shortness of breath, or definite slight angina pectoris. Rapid ascents to a high altitude are very injurious to patients with arteriosclerosis, and the mountain rail-

ways up to 7000 feet and 10,000 feet are positively dangerous to an unsuspecting public, for many persons between the ages of 55 and 70 years consider themselves to be hale and healthy and are quite unconscious of having advanced arteriosclerosis and perchance contracted kidneys.

Bad results in the shape of heart-collapse, angina, cardiac asthma, and last, not least, apoplexy, often occur only on the return to the lowlands; patients with cirrhotic kidneys are in the greatest danger. In the case of apoplexy it is generally the combined influence of a few things, slight in themselves, which, added to the detrimental effect of the high altitude, produce the fatal result. Overexertion immediately after reaching the Alpine resort, overfeeding, an unusual amount of alcohol, exposure to a hot sun, and sometimes constipation neglected for a few days play their part.

Patients suffering from arteriosclerosis at whatever altitude they may be should be kept on an almost vegetarian diet with sufficient mineral water, such as Vichy, Passugg, or Seltzer. They should be restricted in respect of alcohol and strong tea or coffee, and, above all, their walks on hot days must be limited to the hours between 8 and 10 A.M. and from 4 to 7 P.M.

The inorganic serum introduced by Trunecek as a valuable therapeutic agent in arteriosclerosis contains all of the alkaline salts normally present in human blood-serum; the solution is concentrated, but the relative proportions of its alkaline constituent are maintained. Trunecek begins by injecting 1 cubic centimetre (15 minims) of the solution, and the injections are gradually increased till 5 to 7 cubic centimetres ( $1\frac{1}{4}$  to  $1\frac{3}{4}$  fluidrachms) are given daily. The injections are given alternately on the left and right sides, the forearm and gluteal region being favor-

ite sites. The remedy is applicable to cases of sclerosis of the great vessels, arterial cachexia, cerebral arteriosclerosis, and chronic rheumatism. Personal case similar to those cited by Trunecek, characterized by attacks resembling angina pectoris, but occurring nightly for many months. After a single injection of inorganic serum relief was obtained. Satisfactory results were also obtained in cases of cerebral arteriosclerosis with symptoms limited to one side of the body. Not only were local manifestations of the disease, both sensory and motor, greatly modified, but general symptoms were likewise controlled.

The formula for Trunecek's serum is as follows:—

Sodium chloride, 4.92 grammes.  
Sodium sulphate, 0.44 gramme.  
Sodium carbonate, 0.21 gramme.  
Potassium sulphate, 0.40 gramme.  
Distilled water, q. s. ad 100 cubic centimetres.

Leopold Levi (La Presse Méd., Jan. 15, 1902).

Three cases of arteriosclerosis treated with Trunecek's serum show that this remedy fulfills all the claims made for it by the originator. The treatment is based upon the following: Among the inorganic salts in the circulating blood, of which sodium chloride forms about 70 per cent., there is a certain amount of calcium phosphate. This salt, though insoluble in water, dissolves easily in solutions of common salt or of magnesium or sodium phosphate. In normal human serum there are very small amounts of these salts, and the solubility of calcium phosphate in the blood is due chiefly to sodium chloride and to the alkaline phosphates in that fluid. In the tissues sodium chloride is present in considerable quantities, and this amount grows less with age. Arteriosclerosis is chiefly due to the deposit of calcium phosphate in the walls of the arteries, and, as the disease occurs, for the most part, in old persons, it is thought that it is due to a lack of salt in the system. Therefore chloride of sodium and other salts that render the blood alkaline should be administered in this disease.

The solution of inorganic salts should be introduced into the veins or under the skin. Zanoni and Lattes (Gaz. degli Osped. e delle Clin., Jan. 19, 1902).

### Arteritis.

**Definition.**—Arteritis is the inflammation of an artery. When affecting the inner coat it is called *endarteritis*; when the middle coat, *mesarteritis*; and when the external coat, *periarteritis*. Arteritis occurs as a normal process during repair of an injured artery, but the term arteritis as here understood is applied to inflammation of an artery due to local bacterial infection.

**Symptoms.**—Arteritis is often due to neighboring inflammatory processes, the infecting micro-organisms being carried to the vascular vulnerable spot through the connecting blood or lymphatic channels; the disease may then start with the inner coat. On the other hand, the infection may occur at the surface through contamination from a septic wound carelessly dressed. The inflammation then attacks the adventitia and proceeds to the inner coats. The presence of a thrombus brought from a distant purulent process by the current may not only compromise the lumen of the vessel, but by supplying pyogenic micro-organisms, lead to sloughing and perforation of all the coats. If the three coats yield, hæmorrhage follows; if the internal coats alone soften and yield, an aneurism is formed. The symptoms of arteritis may thus assume aspects varying with the causative factors of the inflammatory process. In some cases repair occurs and the vessel regains its normal condition, in others the reparative effort ends in the elaboration of a fibrous cord, composed of the transformed artery-coats.

The active symptoms of arteritis are, on the whole, about similar, whatever be the cause of the trouble, and they are marked according to the degree of steno-



sis present. There is pain over the course of the vessel, tenderness on pressure, and usually some loss of power in the muscles of the affected region. If the artery is superficial, it can be felt as a tense, cord-like structure. Pulsation may or may not be present. When the collateral circulation is not formed sufficiently early there is danger of gangrene.

When hæmorrhage occurs from a large artery, the life of the patient may be endangered. When infectious thrombo-arteritis occurs, metastatic abscesses may appear in various parts of the system.

**Pathology.**—Pathological inflammation of a blood-vessel is always due either to some poison or infection. According to Thérèse (Rev. de Méd., Sept. 10, '98), it is necessarily attended with disturbance of the whole organism. Vessels of calibre sufficiently large to have vasa vasorum in their walls react somewhat differently from those of smaller calibre, since obliteration of the minute vascular vessels may take place without the formation of thrombi. This occurs through the proliferation of the connective tissue and subsequent contraction. In cases of infection a cellular exudate often occurs in the perivascular lymphatic spaces, in consequence of the absorption of the toxic products by the lymph-channels, and it is probably the primary cause of the vascular lesions. Recent investigations indicate also the occurrence of changes in the veins. The nervous system also may have some influence by causing alternate constriction and dilatation of the small vessels, thus giving rise to a condition favorable to escape of the leucocytes.

**Treatment.**—Absolute rest is indicated together with warmth of the part in order to prevent gangrene. Some form of opium may be given to relieve the pain, and nourishing food and tonics are

of the greatest importance in the maintenance of the patient's general health and strength. Mercurial ointment reduced in strength by the addition of vaselin or lard, according to the age of the patient, greatly assists the reparative process, if applied gently with a woolen pledget along the course of the inflamed artery. Chloride of ammonium, 5 grains every three hours, tends to encourage the dissolution of any thrombus that may be present.

### Veins, Disorders of.

#### Phlebitis.

Inflammation of a vein, as here understood, also involves the direct entrance of bacteria into the vessel or by extension from a neighboring suppurative process.

Phlebitis may, however, be acute and subacute.

*Acute phlebitis* is usually the result of some injury accompanied by infection. It sometimes assumes, under the influence of septic traumatism, very grave proportions, leading to pyæmia. The *subacute* form is less grave, and is usually caused by some disease of the vascular coats accompanied by thickening, the accumulation of fibrous tissue leading to narrowing of the vascular lumen.

**Symptoms.**—When the vein is superficial, inspection shows a dull-red line, which corresponds to the course of the vessel. Discoloration of the skin and œdema are noticeable below the seat of obstruction. Upon palpation great tenderness is elicited, the vein is felt as a hard, knotty cord; œdema is often noted. There is pain and stiffness in the limb affected, these being especially noticeable upon movement.

In phlebitis of the deeper veins the only symptoms often consist in deep-seated pain and tumefaction. Constitutional symptoms are seldom serious unless there is pyæmia, when fever attended

by rigors and joint-pains may be present: an indication that general infection is beginning. The tongue is usually dry and coated.

When in the subacute form thickening of the vein occurs, leading to occlusion of the vein, an abscess may form. But unlike arteritis, there is no hæmorrhage, the vessel being collapsed by the newly-formed fibrinous matter and the pressure of the surrounding inflammatory infiltration. Acute phlebitis may be developed, however, through rupture of the abscess and introduction of micro-organisms and their products into the vein. Pyæmia may thus also ensue in the subacute form, but through the development of acute phlebitis as a complication.

**Etiology and Pathology.**—Phlebitis may be caused by varicose veins, syphilis, gout, traumatism, or the absorption of septic material.

The two outer coats are especially involved, and become hyperæmic and infiltrated with serum or pus. The inner coat is cloudy and fissured, and its disintegration may be followed by the dissemination of small masses of *detritus* into the blood-stream. During the inflammatory process a clot forms, which may finally convert the vein into an impervious cord; it may contract so as to occupy only a portion of the lumen, thus allowing the blood to flow past it. Occasionally the morbid vascular tissues disappear entirely by absorption. In some cases a portion of the clot becomes broken off and is carried away into the general circulation, where it may cause a fatal issue by occluding an important vessel. If it is infected with septic material, pyæmia may result.

**Prognosis.**—When phlebitis occurs in the course of any severe constitutional disease, especially in pyæmia, the prog-

nosis is very grave, but a simple phlebitis seldom results fatally.

**Treatment.**—Absolute rest with elevation of the affected limb is to be insisted upon. A wash of lead and opium, mercury and belladonna ointment, or hot fomentations should be applied to the part. Leeches along the course of the vein often prove of value. If abscesses form, they are to be incised. It is important that the diet be easily digestible and nourishing, that the bowels be kept open, and that the general health be maintained at as high a level as possible. When the inflammation has entirely subsided, gentle massage toward the heart may be of advantage in restoring the sluggish circulation of the part. When abscesses appear, they should be opened under strict antiseptic precautions, to avoid migration of pyogenic bacteria and their toxins into the general system. Unless this is resorted to, the micro-organisms and their toxic products also tend to disintegrate the thrombus, and thus to favor their being transported elsewhere, with the results already mentioned.

Streptococcic antitoxin successfully employed in the treatment of a case of septic thrombophlebitis. Notwithstanding usual measures, the patient's condition soon became desperate. Her temperature was 103° F.; pulse, 125 and very weak. The day after first injection of the antitoxin, 10 cubic centimetres, the temperature had dropped to 100 degrees. Another injection of 10 cubic centimetres then given, and by the second day thereafter the temperature had fallen to normal and the pain and tenderness had subsided. The case then progressed to recovery. R. B. Mahon (Brit. Med. Jour., 2055, p. 1220, 1900).

At the beginning of a phlebitis absolute rest is necessary for six weeks or longer. Cold moist applications should be made over the seat of the phlebitis. Later compression can be made by an electric bandage. Later still, massage



will be beneficial, with passive motion. During convalescence the writer advises salt baths, ichthyol ointment, etc. Constitutional treatment for gout, rheumatism, or syphilis may do much good to the phlebitis. Edgar Hirtz (*Jour. des Praticiens*, Aug. 10, 1901).

### Varix, or Varicose Veins.

**Definition.**—A dilated and thickened condition of the veins, especially the internal saphena, which becomes prominent above the surface, knotty, and tortuous.

**Symptoms.**—When the varices are superficial they may be seen as enlarged and tortuous, bluish, tumor-like masses. A dull pain is often present, and there is some loss of power and a feeling of weight in the part. Thrombosis and phlebitis are also frequent accompaniments of this condition.

The superficial veins are usually those mainly affected, the circulation being maintained by the deeper vessels. They often extend to the scrotum; occasionally, the large superficial veins of the abdomen are all involved, a thick, bluish, entangled, arborescent mass of vessels projecting from the surface. In some cases the deeper veins are the first affected.

Infiltration of the surrounding tissues is frequent, but this differs from œdema in that it does not pit under slight pressure. An eczematous eruption often appears in the tissues so affected, which degenerates into an ulcer: the so-called "leg-ulcer," or varicose ulcer. When this complication involves a large varicose vein, dangerous hæmorrhage may ensue. Deep varices are difficult of diagnosis. According to Gay, muscular cramps are indicative of this condition.

**Etiology.**—Varicose veins are caused by an abnormal amount of blood being forced into the veins or by some impediment to its return-flow. The female sex

is more often affected than the male. Heredity, a lowered state of health, occupations which require much standing, tight garters, heart and lung diseases, and tumors of the pelvic or abdominal cavity may all be determining factors in the disease.

**Pathology.**—The veins are lengthened and are sometimes so tortuous that it is difficult to trace the lumen. The greatest dilatation is always situated just above the valves. The latter are often destroyed or are rendered incompetent on account of the dilatation of the vein. The walls are generally very much thinned, but they may be thickened, or fibroid degeneration may occur. When there has been a fibroid periphlebitis the veins become adherent to the surrounding tissues. Their outer coat sometimes becomes extremely thin and allows the internal coat to protrude in more or less lobulated masses. At times rupture occurs, as stated. Thrombi may form in the veins, which may give rise to suppurative phlebitis; at times these thrombi undergo transformation into laminated or hard masses called "vein-stones," or "phleboliths."

There are not only degenerative changes due to distension of the veins, but also a new formation of connective tissue, sometimes quite marked, chiefly in the intima. This gives rise to an endophlebitis characterized by the formation of nodules or flat areas of thickening. In these nodules there is a breaking down of the internal limiting membrane into thinner elastic sheets and fibres, particularly in the large nodules, with a new formation of elastic tissue. The endophlebitis is the primary change in the vessel-wall. Janni (*Archiv f. klin. Chir.*, lxi, 12, 1900).

**Treatment.**—Palliative or radical measures may be used in the treatment of varicose veins. The former include treating the cause, building up the general health, attention to the bowels, and

rest in bed, with elevation of the affected limb. Elastic stockings or bandages are of value for the support they give to the veins, and they should be applied and removed with the patient in the recumbent position. Hæmorrhage may be controlled by elevation of the limb and compression.

The radical treatment consists of some operation for obliteration of a portion of the vein. The operations most commonly in use and of most value are ligation, either upon exposure of the vessel or subcutaneously; acupressure, and excision of the vein. In subcutaneous ligation a needle armed with catgut is passed through the skin on one side of the vein, beneath the vein and out through the skin on the opposite side. The needle is then reinserted at the exact point of exit, is passed over the vein, care being taken not to enter it, and is made to emerge at the original puncture. By tightly drawing together the catgut and tying its ends the vessel is occluded at that point. Numerous ligations are necessary and it is always better to apply the one nearest the heart first. Phelps uses from thirty to forty ligatures, with good results.

An effective method is that recommended by Trendelenburg. This procedure is based on the fact, established chiefly by this observer's investigations, that the primary cause of the varix is insufficiency of the valves of the veins, whereby the weight of the blood-column in the saphena is thrown on the peripheral vessels. It consists in ligating the saphena in the upper part of the thigh. G. Perthes reported 41 cases thus treated, of which 32 were permanently cured. Relapse having been traced in several cases to renewed permeability of the ligatured vein, the rule now is, instead of simply tying the saphena, to ex-

cise a short portion. The results of ligation of the saphena in the thigh, according to Ledderhose (Centralb. f. Chir., Aug. 20, '98), may prove disappointing where collateral veins from the external saphena and from the deep veins open into the main trunk above the point of ligation, or where the internal saphena is duplicated and only one of them is tied; it is recommended, therefore, to investigate very thoroughly the anatomical arrangement of the veins in each individual case before operation, and to apply the ligation high up near the saphenous opening. If the epigastric and pudendal veins open into the internal saphenous trunk, they should also be ligated.

Almost every varix of the lower extremities that required operation treated by the Trendelenburg method: *i.e.*, one hundred and twenty cases. One great advantage of the operation is that it is simple, rarely requiring more than five minutes for its performance. Gas and oxygen are often the only anæsthetic needed. The vein is best exposed by an oblique incision from one and a half to two inches long, parallel with the groin and having its centre over the vein. The vessel is cleared and a double ligature placed on it, one being tied as high up as possible and the other about two inches lower down. The intervening portion of the vein is then cut out. The wound is closed by a few sutures and covered with a collodion dressing; as a rule, the patient is able to be up and about on the eighth day. In only two of the cases did no benefit result from the operation. With the exception of these, all stated that there was less pain, though in a few they spoke of some discomfort after prolonged exercise. The result of the operation in relieving discomfort is remarkably good. In no case was there an increase in the varix. The value of the procedure in retarding the development of the disease is shown by the fact that many of the operations were in young people, in whom some progress in the affection



might have been expected. In many cases the varices shrank, but did not disappear; in some they were flaccid and pendulous. The tendency to thrombosis is markedly lessened. A. P. Gould (Lancet, March, 1902).

The operation which gives the best and most permanent results is that in which not only the varices are removed, but also the trunk of the internal saphena in the thigh, and the result will more certainly be permanent if this portion of the vein is very extensively resected. No doubt recurrence might develop even after this operation, on account of anastomoses gradually developing from the upper end of the internal saphena which is allowed to remain, but results have not hitherto shown a case of recurrence. No operation will radically cure varicose veins, but will only ameliorate the condition. Yet, when patients who previous to operation were unfit for any serious exertion or long standing, and who presented on their legs extensive and prominent varices, and who years after the operation neither show any appearance of varices nor complain of any disagreeable symptoms, surely the operation is worth performing. R. Kennedy (British Medical Journal, Oct. 29, 1904).

In acupressure harelip-pins are passed through the skin and beneath the vein at distances of about one inch apart. An elastic band or a figure-of-eight ligature is then applied over the ends of each pin. These pins may be removed at the end of eight days. H. Lee has modified this operation somewhat by dividing the vessel subcutaneously between the pins, which then need remain only for four days.

*Varicose ulcers* often yield to mere physical support. If the ulcer is kept very clean and dusted with dermatol night and morning and a rubber bandage is carefully wrapped around the limb from the ankle to the knee, it often becomes smaller and finally disappears.

The bandage is only worn during the day.

Ulcers of the legs may be treated in the following manner: After the leg has been washed with hot water or with feebly carbolized water, it is dried by the application of sterilized absorbent cotton, and then painted with tincture of aloes. If the ulcer is superficial, it is only necessary to pass the brush over once or twice; but if it is deeper, a thorough application of three or four coats of the tincture should be resorted to, the patient resting until the application is dry. This application is made for several consecutive nights; it is apt to cause very considerable pain, which rapidly disappears.

The dressing after each application should be covered with rubber dam. After recovery, a flannel bandage should be employed. Coffin (Jour. des Prat., Mar. 21, '96).

Ulcers of the leg are personally treated by exposing them to heat. The flame of a Bunsen burner is made to impinge on a square plate of metal that will stand heating, so as to bring it to a dull-red heat, and the ulcer is exposed to the action of the heat at a distance of about ten inches, the rest of the limb being protected with bandages. The temperature at the ulcer is about 113° F., which is easily borne, and the flame is so regulated as to maintain this temperature during the whole exposure, from twenty minutes to an hour. The surface is then found to be glazed over, and large, granulations are to be seen through the semi-transparent coating. The ulcer is then left exposed to the air for some time, and when it is dressed care should be taken that its surface is not touched by the aseptic gauze or other material used. Improvement is generally experienced even after the first sitting, and cicatrization is completed in from five to twenty-five applications. In the later sittings, when the ulcer is nearly healed, a more moderate heat may be employed. Colleville (Lancet, May 29, '97).

In treatment of chronic ulcer of the leg the first step is thorough antisepsis of the wound and surrounding skin;

procured by first washing the entire leg with soap and water and carefully drying it. Then the area of the wound is covered with calomel, which is converted into a thick paste by mixing it with water. Over this paste salt is strewn and thoroughly mixed in. A gauze and cotton dressing is then applied. The action of the salt upon the calomel produces sublimate. This nascent sublimate is very active, and for three or four hours produces an intense burning, which gradually subsides.

After twenty-four hours the wound is dressed, and a dry wound free from unhealthy granulations is found, which is perfectly aseptic.

The application of unguentum basilicum, with rest in bed, produces a speedy covering of the wound with new skin. Exuberant granulations are touched with crystals of copper sulphate. If there is an area which refuses to heal toward the end of the treatment, a healing ointment is applied to a sterile piece of cardboard, it being held firmly in place with a compressive cotton dressing and bandage. After complete cicatrization the whole lower leg, including the foot, is placed in a fixed dressing for two weeks. The resulting skin is very firm, and does not have the tendency to break down. V. Langsdorf (*Centralb. für Chir.*, Nov. 20, '97).

The treatment of chronic non-specific leg-ulcers of moderate size by strapping is regarded as superior to other usual methods. Strapping of ordinary adhesive plaster spread on stout, pliable holland, supplied in 12-yard rolls, 16 inches wide, is cut into various lengths, according to size of each leg, each length being about  $1\frac{1}{4}$  inches wide, and applied so that the strips overlap by  $\frac{1}{3}$  inch. The foot should be included in the strapping, commencing at the base of the toes and carrying the strapping up the leg to 3 inches or 4 inches above the ulcer, which is completely covered in. A strong calico bandage should be applied over all, from the toes to the knees. Zinc ointment may be applied to excoriations, the lint not being too close to the ulcer, and dressing changed twice a week. On the average, 12 strappings are needed.

After healing of the ulcer, Martin's bandage or an elastic stocking should be worn. Charles Herbert Thompson (*Lancet*, Aug. 27, '98).

In the treatment of chronic leg-ulcer the leg and ulcer should first be scrubbed with soap and water, then curetted. This may be rendered painless by injection of a solution of cocaine in the vicinity of the ulcer. After curetting, the ulcer is brushed with pure carbolic acid and then touched with cotton dipped in alcohol; and a bandage is applied, beginning at the toes and extending as far as the knee. When the ulcer becomes perfectly dry, adhesive stripping is made use of. The heart, lungs, and kidneys should be carefully examined to determine if congestion and œdema of the lower extremities is due to disease of these organs. Corsiglia (*N. Y. Med. Jour.*, March 25, '99).

A formula successfully used: A pint of boiled linseed-oil is heated thoroughly, and in it is put  $\frac{1}{2}$  pound of the red oxide of lead and the mixture allowed to boil thoroughly. After cooling it is again boiled, and on cooling a second time  $\frac{1}{2}$  ounce of gum camphor is stirred in. This forms a diachylon-plaster-like substance which can be spread on a cloth by heating over an alcohol-flame. Good results have been obtained in indurated varicose leg-ulcers, but not in syphilitic leg-ulcers. Buehler (*Phila. Med. Jour.*, Feb. 17, 1900).

Camphor of great value in the treatment of leg-ulcers. The leg having been thoroughly scrubbed with green soap, a moist dressing of solution of aluminium acetate is applied and renewed daily until the secretion is diminished and has become odorless. A wet dressing is then applied every other day, using spirit of camphor instead of water. When the dressing is being changed the ulcer is cleansed with some antiseptic solution, like carbolic acid. The results in about forty cases, the treatment often lasting less than three weeks, were excellent. Walbaum (*Münchener med. Wochen.*, xlviii, No. 26, 1901).

Series of one hundred cases of ulcer of the leg treated with a 1-per-cent. solution of chlorinated lime. This simple,



old-fashioned remedy is the most effective of all at our command. It is applied on several thicknesses of gauze and the leg is wrapped in a tricot bandage, commencing at the toes. The purulent secretions dry up almost at once; the lesion presents a clean, granulating surface and the formation of skin is exceptionally perfect. Zeuner (*Deutsche med. Wochen.*, May 15, 1902).

### Injuries of the Blood-vessels.

**Hæmorrhage.**—When a blood-vessel is injured, hæmorrhage usually follows unless the vessel has been completely torn across and twisted so that the inner coats curl up and occlude the lumen.

Hæmorrhage may be *arterial*, when the blood comes in jets synchronous with the heart's beat, and is bright red—except in the absence of oxygen as in asphyxiation; or it may be *venous*, when the blood flows in a continuous stream, is dark in color; and *capillary*, *i.e.*, characterized by an oozing from the tissues, and which, as a rule, stops upon exposure to air.

Hæmorrhage may also be divided into *primary*, when it occurs at the time of the injury, *recurrent*, or *intermediary*, when it follows within twenty-four hours and during the period of reaction; or *secondary* when it occurs any time after twenty-four hours until the wound is healed.

**PRIMARY HÆMORRHAGE.**—A slight hæmorrhage of any kind is usually recovered from promptly unless the patient's general health is impaired. The almost universal practice of bleeding as a therapeutic measure during the early part of this century showed how even copious bleeding could be benign in immediate results. After severe bleeding the patient's color is lost, the surface becoming pale and the lips white, the extremities are cold, the heart's action is weak, the pulse feeble and rapid, the respiration frequent and at times sigh-

ing. A feeling of faintness is experienced, together with loss of voice and buzzing in the ears. Often the body becomes covered with a profuse cold perspiration, while there may be delirium, collapse, and even death.

Following the hæmorrhage the patient is very weak, the muscles are flabby and soft, the pulse is rapid and easily disturbed, and there is often a slight rise of temperature.

Conclusions regarding post-operative hæmorrhage are: 1. In diagnosing post-operative hæmorrhage the operative history will aid much. 2. The symptoms of shock and those of hæmorrhage are very similar. 3. In suspected cases the cutting of a single stitch in the incision will tell. 4. The surgery must be quick and decisive in these cases. 5. In cases in which bleeding is expected the tube should be used. 6. Large quantities of decinormal saline solution will save many patients. This should be used both per rectum and by injection into the veins. 7. Strychnine, belladonna, etc., will not control bleeding from a uterine or ovarian artery any better than from any other artery. 8. The surgeon should do what his surgical conscience tells him is right. Late researches in hæmatology make it appear that an internal concealed hæmorrhage may be demonstrated by a careful blood-count. This, it is stated, will show a decrease in the red cells and an increase in the white. Very similar symptoms accompany shock from various causes, such as internal hernia, etc., none of which produce a change in the red cells. If an operation was performed for the relief of an inflammatory process, this test would lose its value in part, as there would exist at the time of operating a leucocytosis. Saline infusions apparently increase the white cells at first. A. H. Cordier (*Jour. Amer. Med. Assoc.*, July 6, 1901).

**TREATMENT.**—The treatment of hæmorrhage may be both constitutional and local. It is important to keep the patient in the recumbent position with

the head on a level with or lower than the body, unless the bleeding be from the nose or ears, when the upright position will often cause it to cease. All clothes are to be loosened and the normal temperature is to be sustained by means of warm blankets and hot-water bottles, care being taken in the use of the latter that they are not hot enough to burn the patient. When the bleeding vessel has not or cannot be secured, heart-stimulants should be very carefully given if they are given at all. If, however, the vessel has been secured, strychnine, nitroglycerin, digitalis, ammonium carbonate, or hypodermic injections of ether or brandy are of great value. Rectal, subcutaneous, or intravenous injections of a warm normal saline solution (1 teaspoonful of sodium chloride to the pint of water) are often of advantage in filling the empty blood-vessels, and thus giving the heart something to work upon. Transfusion of blood may also be used.

Analysis of the literature and personal experience with gelatin: 1. Gelatin increases the coagulability of the blood, whether applied locally, taken internally by the mouth, or injected subcutaneously or intravenously. 2. Applied locally, it is usually harmless, and may, as Carnot suggested, aid in healing by improving the nutrition of the cells, although this is personally regarded as doubtful. It may be injurious by promoting bacterial growth, and should probably always have some antiseptic added to it. 3. Injected subcutaneously or intravenously, it is entirely harmless, and, when the technique is perfect, practically painless. The solution should be thoroughly sterile; the dose employed should vary from 1 to 3 grammes of pure gelatin. 4. When administered by the mouth from 1 to 300 grammes, or perhaps more, should be employed daily. 5. It is of advantage in any form of local hæmorrhage, such as epistaxis, hæmorrhoids,

or injuries. 6. It checks certain forms of internal hæmorrhage, such as hæmoptysis, hæmatemesis, metrorrhagia, and melæna neonatorum. 7. It appears to be the best remedy at our command in the treatment of hæmophilia, and to be of great advantage for purpura hæmorrhagica, and in hæmorrhagic forms of infectious disease. 8. At present it appears to be contra-indicated in only one condition, viz.: acute nephritis. Joseph Sailer (*Therap. Gaz.*, Aug. 15, 1901).

### Injuries and Wounds of Arteries.

**CONTUSION.**—An artery may be contused and not give rise to any special symptom, but if badly injured its walls are apt to slough and cause hæmorrhage. Aneurism or obliteration of the artery may also result from this injury, and when the latter occurs in some large or important vessel gangrene of the parts supplied by it may follow. (See **ANEURISM**, volume i.)

**RUPTURE.**—This may be either incomplete or complete. When incomplete the external coat is preserved, the middle and internal being torn. The latter, by curling up, may form the starting-point of a thrombus, thus causing the lumen of the artery to become occluded. In other cases the accident may be followed by an aneurism, or by hæmorrhage the result of an erosion of the outer wall of the vessel.

In complete rupture or laceration, if there is an external wound, hæmorrhage is often severe, but it may be scarcely noticeable, provided the inner coats have been able to act as a barrier. If there is no external wound the tissues become infiltrated with blood or a traumatic aneurism results.

**PUNCTURED WOUNDS.**—A punctured wound is caused by some thin sharp or blunt instrument: a needle, the blade of a knife, etc. It may give no trouble if the wound is small; but, when large,



hæmorrhage may be considerable. This kind of a wound is very apt to be followed by a traumatic aneurism. (See ANEURISM, volume i.)

**INCISED WOUNDS.**—An incised wound may be longitudinal, oblique, or transverse, and is caused by some cutting instrument. When transverse, bleeding is often profuse, and this may also happen with the longitudinal cut if the artery is relaxed, as in the anterior aspect of the elbow—when the arm is flexed. Otherwise in this and in oblique wounds hæmorrhage is not great.

**GUNSHOT WOUNDS.**—In a gunshot wound the bullet may cause merely a contusion, it may cut the artery completely across, giving rise to considerable hæmorrhage, or, if it injures the neighboring vein also, an aneurismal varix may result. This subject has been considered in the various departments in which wounds and injuries have been described. (See ABDOMEN, INJURIES OF, volume i, etc.)

**Treatment.**—Besides the constitutional treatment already referred to, cold in the form of ice, or heat in the form of hot water of about 120° F., locally applied, often causes arrest of hæmorrhage. Heat is to be preferred, however, as it has no depressing action upon the patient.

Pressure, which is often of value, may be applied by means of the finger, by compresses secured by bandages to the bleeding-point or over the main artery, or by a compress placed in the flexure of a joint held *in situ* with a bandage. The latter methods must be carefully watched, as the venous return is interfered with and œdema of the part may arise. Care must also be taken not to bandage so tightly as to cause gangrene. If the actual cautery is used, it must be a very dull red, otherwise it burns away

the tissues, and bleeding returns when it is removed. Styptics should seldom or never be used.

In many cases acupressure is of great value. A harelip-pin or needle is passed through the skin perpendicular to the artery, then under the latter and out through the skin on the opposite side, when a figure-of-eight ligature is thrown around the ends of the pin. Another method consists in introducing the pin or needle through the skin parallel to the artery, then rotating it until perpendicular to the artery, when it is carried across and in front of the latter, to be deeply inserted into the tissues of the opposite side.

When torsion is used in the treatment of hæmorrhage, it is accomplished by catching the end of the cut artery with a pair of forceps and twisting it two or three times until there is no sense of resistance. Care must be exercised not to twist the end off. This method is applicable only when the vessel is entirely cut across.

Ligation is one of the best methods of controlling hæmorrhage from an artery. Silk or catgut ligatures are to be preferred and must be aseptic or antiseptic. If the hæmorrhage is primary and bleeding has ceased, no ligature is needed. When, however, the vessel is still bleeding the surgeon should search for it in the wound and when found should apply a ligature to both ends if the artery is cut entirely across and to both sides of the wound when the vessel is only partially severed. If the distal end cannot be found, the proximal end is to be tied and a compress placed over the wound. In some cases it is impossible to tie the bleeding vessel in the wound and ligation in continuity must be resorted to.

**SECONDARY HÆMORRHAGE.**—When secondary hæmorrhage occurs from a

stump, pressure and elevation may arrest it and should be tried before resorting to other measures. If it cannot be stopped by these means, the wound is to be opened up again—provided the union is not far advanced and the cavity seems to be filled with clots—and the bleeding vessel caught and ligated. If, however, the wound is nearly healed and there do not seem to be many clots, the hæmorrhage is to be controlled by securing the artery, of which the bleeding vessel is a branch, just above the stump, and either applying acupressure or cutting down and ligating it. If hæmorrhage still persists, the main artery may have to be ligated in continuity or even amputation may have to be performed.

When secondary hæmorrhage occurs from an artery which has been tied in continuity, pressure should first be applied by means of graduated compresses to the bleeding-point. In some arteries near the trunk this is the only means by which one may hope to stop the hæmorrhage, but in others, where bleeding still persists, the wound is to be opened, the vessel secured, and a ligature applied above and below the source of hæmorrhage. When, however, the vessel cannot be found or hæmorrhage recurs after ligation, the main artery must be tied, or amputation performed, especially if it is the lower extremity that is involved.

### Injuries of Veins.

Injuries and wounds of veins are not, as a rule, followed by as serious results as in the case of arteries.

Hæmorrhage from a vein is dark in color, and may be stopped by pressure upon the distal side of the wounded vessel, thus distinguishing it from arterial bleeding, which cannot be thus controlled.

Hæmorrhage from the smaller veins usually ceases of itself, while pressure on

the distal side is of value in those somewhat larger. When the large veins are injured, however, ligatures should be applied. Phlebitis and gangrene very seldom follow. When the wound is only on one side of a large vein it is often possible to lift the wall on either side of the wound with forceps and apply a ligature.

### Entrance of Air into Veins.

**Symptoms.**—At the point when the air enters the vein there may often be heard a peculiar hissing or gurgling sound, and frothy bubbles appear in the wound. The patient suddenly becomes pale and is partially collapsed. The heart-beat is irregular, the pulse feeble, and respiration difficult and gasping. Death sometimes follows immediately or may be deferred a number of hours. In cases in which only a small amount of air is introduced recovery may occur.

**Etiology.**—Operations in the vicinity of the large veins at the root of the neck and in the axillary space are especially liable to this accident.

**Treatment.**—Prophylaxis consists in using the handle of the scalpel to separate the fascia in operations about the large veins and in first ligating any vein that may need to be divided.

When the accident has occurred, the wound is to be immediately filled with water, the vein is to be compressed and a ligature applied as soon as possible. The head of the patient should be lowered, and mouth-to-mouth insufflation or other methods of artificial respiration practiced. Cardiac stimulants, as digitalis or brandy, hypodermically, are indicated, and inhalations of oxygen-gas are often of value.

### Vascular Obstruction.

**Thrombosis.**—A *thrombus* is a clot of blood which forms in the heart, blood-vessels, or the lymphatics during life.



Thrombosis is the process of forming such a clot.

Thrombosis may occur in the heart, the arteries, the capillaries, the veins, and in the lymphatic vessels. The coagulum, or thrombus, consists of fibrin inclosing within its meshes a larger or smaller number of blood-globules, which, in rapidly-formed thrombi, are both red and white, producing the dark color of such thrombi when first formed. In thrombi which are of slower and gradual formation, and in those due to projections from the interior of the vessels, the red cells may be absent and the thrombus be colorless or yellowish white. The white cells are present in much larger proportion than in normal blood.

**Varieties.** — A thrombus occupying the position where coagulation began is called a *primitive* thrombus; when it gradually extends from this point along the vessel, an *extension* or *produced* thrombus. A *laminated* thrombus results from a process of continuous coagulation; a *non-laminated*, or *uniform*, thrombus from an intermittent coagulation. When a thrombus adheres to some part of the vessel-wall it is called a *lateral*, or *parietal*, thrombus; when it completely fills the vessel, an *obstructing*, or *obliterating*, thrombus; after a thrombus is formed it may undergo certain changes by which spaces are left in it, giving it a spongy consistency and allowing the blood to flow through it, producing what is termed a *canalized thrombus*.

Finally, a thrombus may be *venous*, *arterial*, *cardiac*, *capillary*, or *lymphatic* according to the vessel in which thrombosis takes place, the most frequent seat of the latter being in the veins, where the circulation is naturally feeble.

**Symptoms.** — The symptoms of this process are those of arrested circulation.

They differ according to the vessel affected. If a main venous trunk be obstructed and a compensatory collateral circulation cannot be rapidly established, there are produced passive hyperæmia, venous dilatation, serous transudation, and occasionally hæmorrhage in the vicinity of the occluded vein, with dilatation of the collateral channels. Moist gangrene may result in extreme cases. According to the location of the vein affected we may have hydrothorax, ascites, or anasarca of an extremity; hæmorrhage from the stomach, intestine, or kidney; cyanosis and œdema of the face and neck, etc. The symptoms of arterial thrombosis are mainly those of arterial embolism.

**Diagnosis.** — The diagnosis is usually easy if close attention to the history of the case and the symptoms be observed. Differentiation of thrombi and post-mortem coagula may be made if the fact is borne in mind that a post-mortem coagulum never completely fills the vessel, as after the clot has shrunk there is no further supply of blood to fill up the space between the latter and the vessel-wall; post-mortem coagula are never laminated, are looser in texture and moister, do not adhere so closely to the wall of the vessel, and, though they may be either colored or colorless, they never exhibit the appearances due to the changes which normally take place in thrombi.

**Etiology.** — Thrombosis may be due to certain alterations in the lining membrane of the vessels, producing an obstruction or roughening, and to retardation or arrest of the circulation; the presence of foreign bodies and of the microzymes of septic processes may be considered as having a causal relation to this process. Hyperinosis, or abnormal increase in the fibrin factors of the blood,

and diminished fluidity, as in cholera, may be regarded as predisposing causes which may become active in conjunction with a retardation of the circulation. Of all these causes, retardation of the circulation is the most important.

The principal causes of *venous* thrombosis are two. The first cause is injuries of veins where Nature's method of arresting hæmorrhage is the formation of thrombi. The thrombus may extend along the vein, causing blocking of venous trunks at a distance from the original site of the injury, as is seen after parturition, where thrombosis of the uterine sinuses may extend to the iliac and femoral veins. The second cause is inflammation of the layers of the vein, by altering the condition of the lining membrane; in many cases of phlebitis, however, the thrombosis is the primary lesion, the inflammation of the layers of the vein being secondary. Other causes of venous thrombosis are pressure upon the veins; dilatation; arrest of the circulation in the capillary district of the vein, from embolism or inflammatory stasis. Finally, weakened heart-action, as in marasmus and other exhausting diseases, may cause sufficient retardation of the circulation to induce venous thrombosis; these latter are mostly met with in the veins of the lower extremity and the pelvis, less frequently in the sinuses of the dura mater.

*Arterial* thrombosis may be caused by wounds and injuries, by degeneration of the lining membrane of the arteries, by aneurisms (by stagnation coagulation), and any condition, as embolism, that produces arrest of the circulation.

*Cardiac* thrombosis may be caused by endocarditis, imperfect emptying of the cavities and consequent stagnation due either to valvular stenosis or lack of tone in the heart-muscle.

*Capillary* thrombosis may be caused by

an extension from the veins and arteries, or it may be primary.

*Lymphatic* thrombosis is chiefly due to alteration in the constitution of the lymph whereby it acquires the property of more ready and perfect coagulation, normal lymph being only slightly coagulable. This form is mostly observed during the puerperium, in the uterine lymphatics and their continuations to the lumbar glands, and more rarely in the thoracic duct.

**PATHOLOGY.**—The first change in a thrombus is a shrinking process, during which it becomes denser. Decolorization follows, and it becomes tougher, denser, or even somewhat friable. The subsequent changes vary much.

The thrombus may continue to shrink and dry up until it becomes tough and leathery or even calcified (phleboliths).

Softening may take place either as a result of molecular disintegration or more rarely of suppuration. In the former case the thrombus liquefies, forming a milky fluid consisting of an oily and granular *detritus*, the softening beginning in the centre.

Suppuration occurs occasionally in venous thrombi surrounded by, or leading from, inflamed parts, the number of leucocytes in the thrombus becoming increased either by proliferation or immigration and the whole melting down into a purulent fluid. The wall of the vein, in these cases, is itself always inflamed, and these softened and broken-down thrombi are a common cause of embolism.

Finally, the thrombus may become organized, new tissue growing into it from the vessel-walls and forming a vascular reticulated connective tissue, in the meshes of which are found the remnants of the red blood-globules and fibrin of the clot. Progressive dilatation of the newly-formed vessels gradually renders the



thrombus cavernous (canalized thrombus), and finally, by their coalescence, the clot finally disappears and the vessel again becomes pervious.

Thrombosis of the crural veins is more common after pelvic operations than is generally recognized. It occurs frequently in those cases in which large tumors of the pelvic organs have been removed. It rarely follows extrapelvic operations. In this series it has been infrequent after infected cases. The anæmia and cachexia in consequence of new growths seem to be factors in its causation. Constipation and the use of enemata play a doubtful part in the etiology. Traumatism at the time of the operation should be borne in mind, and deep retractors used with extreme care. Infection is undoubtedly of great importance, but its frequency is difficult to decide. This complication often occurs when least expected and usually late in convalescence. Albumin in the urine is more frequent in these cases than in those running an uninterrupted course. Rest and elevation for the full length of time are excellent. Schenck (New York Med. Jour., Sept. 6, 1902).

**Treatment.**—The treatment of thrombosis varies according to the seat of the process, and is mainly prophylactic. Great care should be taken that the thrombus does not give rise to emboli. It is necessary, therefore, to keep the part at rest until organization or absorption of the thrombus has taken place.

As a preventive of thrombosis in the veins of the lower extremity after abdominal operations, raising the foot of the bed after all operations within, or in the region of, the abdomen has been personally performed, and thrombosis has not been observed except in one case, in whom, for some reason or other, the raising of the foot of the bed was omitted. Where the heart's action was weak, and the blood-pressure was low, recourse was also had to stimulants, to infusions of salt solution, etc. Care was also taken that the bandages did not compress the saphena or femoral veins. Lennander (Centralb. f. Chir., May 13, '99).

**Embolism.**—Embolism is the arrest in the arteries or capillaries of some foreign body which has been carried along in the course of the circulation. The term "embolus" is applied to the foreign body or substance which, being carried in the blood-stream to some other part of the circulatory system, is arrested and forms a plug which occludes the vessel in which it is arrested, and may consist of a detached fragment of a thrombus, a vegetation or vegetations detached from the heart-valves, fragments of tumors which have grown within or into the blood-vessels, air-globules, fat-globules, etc.

The effects caused by arterial embolism are: First, a transient anæmia of the territory supplied by the occluded artery, which may pass away without leaving any permanent consequences. Secondly, necrosis of this territory, which may be either sudden, in the form of gangrene, or more gradual, in the form of softening or wasting. Thirdly, the formation of an hæmorrhagic infarction or congestion of the territory, followed by extravasation of blood into the tissues and the formation of a firm, solid, wedge-shaped patch of dark-red color, the apex of the wedge toward the embolus and the base toward the periphery. In the brain and other very soft organs the extravasation may disintegrate the tissue and cause the ordinary phenomena of an apoplectic clot. These hæmorrhagic infarcts may undergo a variety of changes. Degeneration usually sets in, the patch becomes more or less decolorized, undergoes molecular disintegration, contracts, and finally leaves a depressed fibrous patch in which the remains of the altered blood may often be recognized. Again, the patch may soften down into a puriform fluid, which may become enveloped by a fibrous capsule, and ultimately dry up or become the seat of calcareous deposit. These patches,

when recent, are generally surrounded by a zone of congested vessels.

When the emboli possess irritating or poisonous qualities, such as those derived from the puriform softening of venous thrombi in cases of septic inflammation, the mechanical effects will be the same as those previously described. These emboli, however, set up a suppurative inflammation in their vicinity, wholly independent of any circulatory obstruction, and giving rise to pyæmic abscesses in all parts of the body, while the effects of obstructed circulation are more or less local in character. Simple emboli small enough to become first arrested in the capillaries either produce no permanent change, or, at most, a punctiform hæmorrhage; infectious emboli, however, occasion the miliary abscesses observed in pyæmia.

**SYMPTOMS.**—If the occluded artery be of some size and supply important organs, the symptoms will be those of temporary arrest of function of the part supplied by the artery, as transient paralysis, dyspnoea, coldness of the extremities, etc. Should the artery be small, and not supply important organs, no symptoms may be caused.

**Fat-embolism.**—Fat-embolism is caused by injuries, especially those of the bones and soft parts in which there is an abundance of fat, especially when there is considerable crushing of the parts and many fat-cells are broken down and liberated. These minute fat-globules mingled with the effused fluids and wound secretions may enter the circulation through the lacerated vessels and produce positive symptoms, the severity of which depend upon the quantity of fat which has gained entrance into the circulation and the rapidity with which it has entered.

**SYMPTOMS.**—The symptoms usually

develop within from thirty-six to seventy-two hours after injury, although fatal cases have been reported in less than twelve hours. The lesser degrees of this disorder are marked by restlessness, anxiety, slight dyspnoea, accelerated breathing, and rapid pulse. In more severe cases these symptoms become aggravated: general prostration rapidly increases; the face becomes pale and anxious; and, later, cyanosis, mental excitement, delirium, somnolence, and coma succeed each other. The dyspnoea becomes alarming, the respirations very rapid and finally stertorous. Edema of the lungs develops; hæmoptysis may occur. The pulse—weak and irregular—finally becomes imperceptible. The temperature, at first below normal, may remain so, or, according to the development of secondary complications, may rise later. Examination of the urine will reveal oil-globules floating on the surface.

**DIAGNOSIS.**—The symptoms of fat-embolism resemble more or less those of shock, ether-anæsthesia, acute septicæmia, acute pulmonary and renal congestions, cerebral hæmorrhage, and embolism. From shock it differs in that its symptoms appear so late that the symptoms of shock should have in great measure subsided, and in many cases where the amount of shock has not been very great from the start. The effects of ether are not easily distinguished from the effects of fat-embolism; the appearance of oil-globules floating upon the urine will denote the presence of fat-embolism. The symptoms of acute septicæmia are developed later than those of fat-embolism, and include a marked elevation of temperature and a more gradual development; the two conditions are not infrequently present in the same case. Not infrequently the sequence of shock, fat-embolism, and acute septicæmia is noticed



Although the symptoms of acute pulmonary congestion are sufficiently clear, it may happen that those of fat-embolism will be confounded with them.

**ETIOLOGY.**—Fat-embolism, to a greater or less degree, occurs in almost every fracture in adults and in operations involving the cancellous tissue of bone. Its most severe forms are likely to be developed in extensive compound and multiple fractures, causing symptoms which complicate and succeed those of shock and often resulting in death. This condition is rare in children. The conditions predisposing to it are patent blood-vessels bathed in secretions containing liquid fat and the application of some pressure tending to force the fat into the open vessels. The local congestion and the abundant secretions poured out into the wounded tissues for several hours after an injury cause a tension of parts, which furnishes such pressure.

**PATHOLOGY.**—The fat-globules, having entered the general venous current, are carried to the right side of the heart and onward with the blood-stream into the pulmonary circulation, the finer vessels of which they occlude, and the presence of the fat in which vessels gives rise to the primary symptoms. Gradually the oil-molecules are forced through the lung and pass on into the general circulation. The capillaries of the brain or spinal cord may arrest them and give rise to symptoms denoting disturbances of these organs. The oil-molecules are, however, more frequently arrested in the kidneys and liver. The oil is excreted by the kidneys and may be found in the urine; its presence in the urine is of great diagnostic value.

**PROGNOSIS.**—Fat-embolism in its lesser degrees is speedily and spontaneously recovered from. When the symptoms are severe, the chances of recovery are slight.

If the patient survives for forty-eight hours, recovery is probable.

**TREATMENT.**—To prevent this accident to any great degree is the first indication. To this end the injured part should be immobilized, and free drainage should afford relief from any undue tension. The vital powers, especially the heart-action, are best sustained and stimulated by alcohol, digitalis, and strychnine in full doses.

**Phlegmasia Alba Dolens.**—Phlegmasia alba dolens (milk-leg; white leg; marble-leg) is the term applied to a swelling of one or both lower extremities, beginning either at the ankle and ascending or at the groin and extending down the thigh, occurring usually between the tenth and twentieth days after confinement, and characterized by pain, tension of the skin, and a milk-like whiteness of the surface. The popular name “white leg” was received from its color when it was supposed to be due to a metastasis of milk. As the surface is glossy, as well as white, resembling that of polished marble, the disease is sometimes called “marble-leg.”

**SYMPTOMS.**—As a rule, this affection is preceded by a slight access of febrile phenomena, but its onset may, as an exception, be announced by a chill or distinct rigor. Sometimes an indefinite feeling of malaise, with gastric disturbance, anorexia, coated tongue, and constipation, will be present for a day or two, before the pain in the limb is complained of. Another premonitory symptom may be present, namely: pain and tenderness in the region of the womb, especially marked on that side corresponding to the limb about to become affected. The first characteristic symptom is the development in the limb of a dull, dragging pain, which is increased by motion. This soon develops, as a rule, into acute pain along

the course of the femoral vein, in the calf, or above the ankle, according to the locality in which the affection originates. In these situations the thrombosed veins can frequently be felt, but not invariably, for the tenderness or the swelling may prevent its being made out. The pain and tenderness extend all over the affected parts, which may be the whole limb, causing a feeling as of aching in the bones. The pain is sometimes along the internal saphenous vein, which may be traced till it dips to join the femoral.

Concurrently with the appearance of pain, or within a day or two after it, swelling is observed, which gradually spreads and increases in hardness. This swelling does not resemble ordinary œdema or anasarca as to the sensation it communicates to the hand of the physician, or in the history of its commencement and progress. When it first appears, and again, as it disappears, it may be soft and may pit on pressure; later, when it is fully developed, a few days after its appearance, it is very tense and resilient, nearly as hard as a solid India-rubber ball, and does not pit on pressure. The swelling may spread at once all over the limb, but frequently it either commences above at Poupart's ligament and spreads downward or at the ankle and ascends. It is not often that the lower portion of a limb alone is affected; involvement of the upper parts alone is likewise very rare. The swelling affects all parts of the limb evenly, and rounds off its figure, but does not distend the skin or destroy the form as in anasarca. Coagulable lymph exudes if the skin be pricked. An erythematous blush is occasionally noticed over parts of the limb, but this is not common, and may be confined to a narrow path along the course of a subcutaneous vein or a lymphatic vessel.

The limb may be kept in a state of ex-

tension or of slight flexion. Movement of it causes considerable suffering, and the power of voluntary motion is almost completely lost while the disease continues. The ordinary termination of this disorder is by absorption of the thrombus, with restoration of the circulation.

At the expiration of from five to ten days the symptoms begin to abate, the pain and swelling diminishing. The rate at which this proceeds varies greatly, being probably more or less directly in proportion as the permeability of the vessels is restored. In a favorable case it may be several weeks before the disease disappears; in other cases further or even indefinite delay may occur. The febrile movement in this disease is not usually severe; the temperature rarely exceeds 102° F., and is often less.

DIAGNOSIS.—The diagnosis of this disorder is usually easy, if the history of the disease is carefully considered. Œdema with phlebitis or accompanying varicose veins may resemble it, but the history of the case will usually differentiate them.

ETIOLOGY.—This disorder is most frequently observed during pregnancy and the puerperal period. Its appearance is probably favored by the hydræmic condition of the blood which prevails during the former period, and on the natural formation of thrombi in the uterine sinuses at its termination. Other conditions favor the appearance of phlegmasia dolens: convalescence from fevers—especially typhoid, dysentery; disease of the rectum, malignant uterine disease, uterine fibroids, arrest of the menses, and general malignant or tubercular disease. The disease has frequently been observed to affect the leg on the side corresponding with a previously-commenced pleurisy. When this disease occurs in connection with malignant disease of the



uterus, it often assumes a light and chronic form.

Twelve per cent. of one hundred and thirty-five soldiers treated for typhoid fever in the Pennsylvania Hospital suffered from milk-leg. This is six or eight times as frequent an occurrence of this complication as has generally been noticed. No sufficient reason could be assigned for this. This trouble has usually been ascribed to phlebitis, but there is not necessarily any inflammation of the vein antecedent to the thrombosis. Da Costa (*Inter. Med. Mag.*, Jan., '99).

**PATHOLOGY.**—In some cases this disorder may be considered as the extension of an inflammatory process from the genitalia to the perineum, the nates, and the upper portion of the thigh. If this be confined to the subcutaneous and intermuscular cellular tissue, the vessels may not become affected. If, however, the morbid changes follow the sheaths of the vessels, the walls of both veins and lymphatics become thickened, and in most cases secondary thrombosis results. In other cases thrombosis is apparently the initial lesion. It may occur spontaneously from a retardation of the blood-current; the presence of varicose veins will favor thrombosis. The crural and its branches, the tibial and the peroneal veins are the vessels usually involved. The intravenous coagula may, however, take their origin at the placental site, and, extending along the pampiniform plexus to the hypogastric vein, may thence occlude the crural vein to Poupart's ligament, or, passing upward by the spermatic veins, they may obstruct the vena cava. In some instances the occlusion of one crural vein is followed by occlusion in the other; in that case phlegmasia develops in both extremities. From our present information, no theory of the disease can be regarded as absolute, definite, or exact.

**COMPLICATIONS.**—Among the less

grave complications of this disease are inflammation and suppuration of the intrinsic joints of the pelvis, erysipelas, limited abscesses of periphlebitic origin, diffuse suppuration of the connective tissue, and gangrene of any part or of a varying amount of the entire lower portions of the affected limb. The more fatal complications are embolism and pyæmia. The former is consequent upon the detachment of a thrombus in the femoral, or in still larger veins, or of a slower breaking up of blood-clots into *débris*, more or less puriform, which enters the circulatory current, and induces a general toxæmia, septic or non-septic, according to the conditions under which the clots suppurate.

**SEQUELÆ.**—The most frequent sequel of this affection is persistent aching of the limb, which is increased by cold, dampness, derangement of the health, and exercise; more or less persistent œdema of the ankles, deficient muscular power, and even wasting of the limb have been observed. As a rare exception, great hypertrophy of the cellular or connective tissue has been noticed, simultaneous with muscular atrophy; this cellular hypertrophy may be associated with more or less extensive and intractable ulceration, which probably result from permanent destruction of large vascular areas (Duncan and Gervis).

**PROGNOSIS.**—The prognosis depends upon the origin of the phlegmasia and upon the nature of the complications. The danger of death from sudden obstruction of the pulmonary artery is always present until the thrombus has disappeared or become thoroughly organized. Embolism has proved suddenly fatal as late as thirty-seven days after delivery.

**TREATMENT.**—The principal indications for treatment are: opium to relieve

the pain, cathartics if constipation be present, quinine, iron, good food, and restoratives to sustain the strength and rest for the swollen limb. The extremity should be kept either in an extended or flexed position, whichever proves the more comfortable, and supported on a pillow raised at the foot, with the pressure of the bedclothes kept off by a cradle. Hot fomentations have been advised, but greater relief obtains during the early stages of the swelling by wrapping the limb in cotton batting sprinkled with equal parts of belladonna and chloroform liniments, with oil-silk outside. If vesicles form on the surface, they should be punctured and the fluid be allowed to escape. When the swelling is subsiding, and the limb begins to pit on pressure and the tenderness to subside, absorption may be promoted by gentle frictions with alcoholic lotions and by applying a light, flannel roller bandage evenly over the entire limb. The patient should not be allowed for any reason to leave her bed until every trace of tenderness and thickening has disappeared from the veins. For some time after recovery the patient will do well if she wear a long elastic stocking, as the limb will swell, as the result of standing or of protracted exercise. Frictions, bandaging, and faradization may be required to relieve the swelling, œdema, and muscular weakness. In using frictions of all kinds the danger of dislodging a thrombus is not to be overlooked.

### VASCULO-CARDIAC NEUROSES.

**Palpitation.**—Although this term means the rhythmical normal action of the heart, it is commonly applied to undue frequency of the beats, sufficiently marked to cause discomfort, accompanied by more or less irregularity in the rhythm.

**SYMPTOMS.**—The slight attacks of palpitation with which most of us are familiar are accompanied by more or less oppression and præcordial distress. During violent paroxysms these manifestations are increased in proportion, and the heart-beats may become tumultuous; the beat against the chest is violent; the patient can only speak with the greatest difficulty; his face is pale and covered with cold sweat, and he may suddenly lapse into unconsciousness. While the arteries throb violently, the throbbing may not correspond with the cardiac pulsations. The radial pulse may seem quite normal and violent cardiac action exist. Again, the heart may simply beat with greatly-increased force without necessarily involving the rapidity of its pulsations.

In some cases—individuals subject to “stage-fright,” for instance—violent palpitations may precede entrance upon the stage; as soon as this is accomplished, the heart’s action becomes regular in every way. Mental exertion here does what physical exertion will do in other cases, and what is branded “cowardice” in some young soldiers is often but the cardiac manifestation of excitement, which soon disappears after an action involving physical effort has begun. In some cases, especially hysterical women, the least emotion may bring on an attack.

The physical signs are negative, as a rule, unless some form of valvular disease be present. The ring of the sounds is merely accentuated. In cases of anæmia or neurasthenia a murmur is sometimes heard.

**ETIOLOGY.**—Palpitation is much more frequently met with among females than males, especially around puberty and the menopause. Uterine and ovarian affections and hysteria are commonly ob-



served in cases subject to cardiac neuroses of all kinds. In men it is liable to occur when the anxiety of business and responsibilities of life accumulate. Emotions, excitement, and fear are well-known causes. The abuse of certain beverages, particularly tea and coffee, is considered a factor in the history of some cases. The inordinate use of tobacco may be included in this class of cases. Various diseases—especially digestive disturbances, anæmia, and chronic valvular disorders—are active as causative disorders in but a small proportion of cases. It may follow acute fevers and continued overexertion, as witnessed in armies—the “irritable heart” of Da Costa.

**TREATMENT.**—General tonics, especially strychnine, are indicated, besides appropriate measures for any general or local disorders that may be present.

### Irregular Heart (Arhythmia).

**SYMPTOMS.**—Under this head is included a large number of types of cardiac irregularity both as to power of the heart-beat and as to time: *i.e.*, the interval between the beats. *Intermittence* is said to occur when one or more beats are missed more or less regularly. This is often due to undue weakness of a systole, the cardiac wave failing to reach peripheral portions of the arterial system. The *pulsus alternans* of Traube also denotes irregularity in the power of the pulse-beat: *i.e.*, one pulsation being normal, the next feeble. The *pulsus paradoxus* of Kussmaul, observed during various disorders, especially pericarditis, aortic constriction, and myocardial debility, is a curious form of irregularity: the heart-beats are more frequent, but weaker, during inspiration than during expiration. The *pulsus bigeminus*, or twin-pulse, is characterized by two suc-

cessive rapid beats, the diastole being shortened; then two successive slower beats, the diastole being lengthened. The first beat is usually stronger. This pulse sometimes denotes the presence of mitral disease, and it occasionally appears when digitalis is administered. Three or four beats may be thus united instead of two. In *delirium cordis* all the forms of irregularity mentioned may more or less co-exist as the result of an advanced heart-lesion, especially valvular and involving dilatation, or of exophthalmic goitre.

The rhythm of cardiac action is often disturbed, as instanced in the gallop, or *bruit de galop*, rhythm, in which succession of raps on a pavement by the hoofs of a horse while cantering is imitated. It is observed in advanced arteriosclerosis, interstitial nephritis, anæmia, and myocarditis. *Embryocardia* is another disturbance of rhythm, in which the sounds of the foetal heart are imitated, namely: great similarity between the first and second sounds and a shortened interval between each set of beats. It resolves itself into practically continuous beats of the same character. *Embryocardia* is observed when great dilatation is present or after prolonged fevers.

Cardiac irregularity may exist many years without being detected, and that in a person in apparently excellent health. But cardiac disease more or less marked is usually present.

**ETIOLOGY AND PATHOLOGY.**—The precise origin of arhythmia is not known. The heart-wall is often found diseased, fatty degeneration and sclerosis extending to the coronaries being the prevailing pathological changes. The cardiac ganglia may be similarly affected. Besides the disease mentioned, arhythmia may be due to toxic influences, the inordinate use of tobacco, coffee or tea,

belladonna, aconite, digitalis, or veratrum viride.

Leyden contends that tobacco indulged in to excess undoubtedly causes myocarditis with true fatty degeneration of cardiac muscular fibres. The tendency of the profession is not to realize how permanent may be the cardiac injury its use may entail.

Mendel has noted, in a large number of cases of heavy smokers, that the arteries become thickened, hardened, and tortuous long before the atrophic changes of old age begin to be manifested. He has especially noted this arteriosclerotic condition in persons between thirty and forty-five years of age. *Berlin Correspondent* (*Med. News*, Jan. 22, '98).

It may also follow severe head-injuries attended by cerebral hæmorrhage or concussion, or attend various mental, gastric, hepatic, pulmonary, or renal disorders.

**TREATMENT.**—Rest of body and mind are important factors in the treatment of this condition. The patient is usually anxious concerning his condition, and imagines that death may overtake him at any moment. He should be quieted. Shocks, mental and physical, should be avoided; cold douches and debilitating hot baths should be avoided, tepid baths being recommended, followed by rubbing with a coarse towel. Attention to the diet and the avoidance of coffee, tea, tobacco, and sexual excitement represent the most important hygienic rules to be observed. Tonics, especially strychnine, are always useful whatever be the cause; in some cases it may be given with digitalis. The bromides are of value for temporary use, but should not be persisted in, since they tend to debilitate the organism and thereby increase the cardiac disorder in the long run.

#### **Rapid Heart (Tachycardia).**

Abnormal rapidity of cardiac action, regular and unattended by other symptoms, is sometimes observed. Perfect

health may exist notwithstanding, just as it may be present in association with an abnormally slow pulse. Tachycardia may only be said to exist therefore when from some cause a normal pulse is rendered abnormal, and so remain for a time more or less prolonged or in paroxysms varying in duration.

**SYMPTOMS.**—An attack of paroxysmal tachycardia may appear suddenly after a violent emotion, a fright, or represent the continuation of rapid action occurring as the result of violent exercise or excitement. The pulse may, under such circumstances, beat sufficiently rapidly to render counting totally impossible, especially since the sharp beat of the period of excitement is replaced by one which renders the pulse weak, compressible, and thin. In powerful individuals, however, it may remain hard and strong and may then be accompanied by great præcordial discomfort and pain: a condition resembling angina pectoris. All the manifestations of palpitation may then occur.

**ETIOLOGY AND PATHOLOGY.**—The true nature of this symptom is not established. Medullary disease, pressure upon the pneumogastric, or organic changes in either structure have been noted post-mortem. Wood ascribes the disorder to lesions of the accelerator centres. Martins considered it as the manifestation of an acute cardiac dilatation.

Physiology can help one but little in explaining paroxysmal tachycardia, nor is one able to understand how the normal heart-rate can be multiplied four times for hours or days together without apparent damage to the organ. It seems rational to believe that these attacks are epileptiform in character; but unfortunately this leaves us about as much in the dark as we were before, except as to the indications for treatment. Joseph O'Carroll (*Medical Press*, Jan. 7, 1903).



**TREATMENT.**—Huchard advises the following: 1. During the attack physical and mental repose must be secured. The patient should be placed in bed, and lie on the right side as much as possible. The head should be low, because syncope is always to be feared. Czermak and Quincke think that the heart may be slowed by light compression of one or the other of the carotids. In one of Nothnagel's cases the paroxysm could be arrested by deep inspiration; a spray of chloride of methyl in the præcordial region or on the back of the neck sometimes succeeds. Digitalis may be effective or not. 2. During the interval between the attacks, abstinence from tea, coffee, liquor, and, above all, from tobacco. Disturbances of the alimentary canal must be avoided, as well as any physical or mental excess. In cases where the arterial tension is very low, quinine and ergot in pill form have given good results. Antipyrine has been employed by Huchard without success, and veratrum viride has also failed. In several cases nothing has ended the paroxysm so quickly as an injection of morphine.

The application of the ice-bag to the præcordial region produces an increase of the systolic force by acting directly on the myocardium, an increase of the blood-pressure, diminution of the number of the cardiac pulsations, and the disappearance of irregularities of the pulse. It also favors the pulmonary circulation and the respiration. Isnel (Thèse de Paris, '95).

#### Slow Heart (Bradycardia, or Brachycardia).

Slowness of the pulse is often observed in old people and occasionally during middle age, without evidence of impaired health. But a slow pulse does not invariably mean that the case is also one of slow heart, since every other beat of the latter may fail to be transmitted

peripherally, and thus convey a wrong impression as to the rapidity of cardiac action.

**SYMPTOMS.**—A *bona-fide* case of slow heart—determined by auscultation—may give rise to no subjective symptom, especially when permanent; in some cases it occurs in paroxysms. In such patients vertigo is first complained of, and the sufferer may become unconscious; the enforced recumbent position with the head on a level with the body usually enables the patient to quickly return to consciousness, but, on attempting to rise, he is apt to resume the syncopal state. Tinnitus, *muscæ volitantes*, and marked prostration are complained of between the attacks. The pulse at such times may become extremely slow: below ten, in some cases. When such attacks occur in aged individuals death may occur, especially if the patient is allowed to assume even the sitting position suddenly. Such cases are rare, however.

**ETIOLOGY AND PATHOLOGY.**—Riegel, who has carefully studied this subject, states that the pulse may be greatly lowered during the puerperal state whether the labor be premature or at term and during prolonged fasting. This he terms physiological brachycardia. The pathological variety often follows the acute fevers, especially pneumonia, typhoid fever, acute rheumatism, and diphtheria; and is the result of exhaustion (Traube). It may also be caused during gastric disorders, ulcer, cancer, or even chronic dyspepsia (the result, probably, of insufficient nutrition), and occasionally as the result of disorders of the respiratory tract, especially emphysema. It is not infrequently met with in connection with fibroid and fatty changes in the heart, but seldom with valvular disease. Nephritis; uræmia; poisoning by lead, tobacco, alcohol, coffee, and digitalis; anæ-

mia, chlorosis, and diabetes; apoplexy, epilepsy, cerebral tumors, affections of the medulla, injuries of the cervical cord; general paralysis, mania, and melancholia; cutaneous and other affections of the genital tract, sun-stroke, and exhaustion from any cause, may, according to Riegel, be associated with slow pulse.

**TREATMENT.**—The recumbent position, strictly enforced, is of the greatest importance until the heart has resumed its normal action. Caffeine, chloride of ammonium, strychnine, and atropine are the most effective remedies, and digitalis in small doses may be given as a cardiac stimulant. Small doses of whisky or brandy—a tablespoonful of brandy or whisky in a little hot water repeated every two hours, when the patient can drink—is a very effective means. Large doses are more hurtful than beneficial.

**VENOMOUS WOUNDS.** See WOUNDS AND STINGS, VENOMOUS.

**VERATRUM VIRIDE.**—*Veratrum viride* (U. S. P.), or American hellebore consists of the rhizome and roots of *Veratrum viride* (Indian poke, poke-root, or swamp-hellebore; nat. ord., *Liliaceæ*): a plant indigenous to the United States. This remedy should not be confounded with *phytolacca*, which yields the officinal poke-berries and poke-root. *Veratrum viride* contains a number of principles, the chief of which are, however, jervine and veratroidine, which are so closely associated with the resin as to be separated from it with great difficulty.

**Preparations and Doses.**—*Veratrum viride* (U. S. P.), 1 to 5 grains.

*Extractum veratri viridis fluidum* (U. S. P.), 1 to 5 minims.

*Tinctura veratri viridis* (U. S. P.), 1 to 5 minims.

**Physiological Action.**—*Veratrum viride* is a powerful spinal and arterial depressant, exerting little or no direct influence upon the cerebral centres. In full therapeutic doses it lowers the pulse-rate both by a direct action on the muscle (jervine) and by stimulating the inhibitory nerves (veratroidine); it diminishes the force of the heart-beat by a direct influence upon the cardiac muscle (jervine), and produces a general vasomotor paralysis (jervine) more or less complete, according to the doses. Under its action the functional activity of the skin is greatly increased; but, as this is a necessary result of the profound arterial impression, there is no reason for believing that the drug has any specific influence upon the perspiratory glands. In a similar manner the excretion of bile is often indirectly increased by *veratrum viride*, through the excessive vomiting which it induces (H. C. Wood). The temperature is lowered very decidedly by this drug, but whether directly or indirectly has not been determined.

**Poisoning by *Veratrum Viride*.**—An overdose of this drug is followed by a sensation of burning and pain throughout the alimentary tract and an inability to swallow, accompanied with vomiting and diarrhœa; palpitation; slow, weak pulse; and labored respirations. The pupils are generally dilated. Convulsions may be present. Death may occur through paralysis of the respiratory centres. Overdoses of it provoke vomiting so soon and so certainly that it is somewhat doubtful whether a robust adult could be killed by a single dose of any of its official preparations, especially if prompt and judicious treatment were afforded. Alarming symptoms may, however, result from large medicinal doses repeated at short intervals, but they generally yield promptly to treatment.



*Treatment of Poisoning by Veratrum Viride.*—In cases of poisoning by veratrum viride Wood states that “vomiting should be assisted by copious draughts of warm water until the stomach is well washed out (lavage by means of stomach-siphon may be used). The patient should then be made to lie flat upon his back, with the head lower than the feet, and all efforts at vomiting should be restrained. If they cannot be checked, and if the prostration be severe, on no account should the patient be allowed to rise up, but must be made to vomit into a towel. A full dose of laudanum should be given by the rectum, and brandy or whisky be administered by the mouth. If the stomach refuses alcohol in any shape, the rectum should be made use of. Ammonia may be employed as an adjuvant to alcohol, and in extreme cases may be injected into a vein. Amyl-nitrite inhalations are said to have been of service. External heat is important, and mild flagellations, rubbing with coarse towels, sinapisms, etc., may be used to keep up external capillary circulation.”

Atropine, alcohol, opium, coffee, hypodermics of ether and of strychnine, cardiac and respiratory stimulants, extreme heat, and the head placed low are suggested by others.

**Therapeutics.**—The chief use of veratrum is as a circulatory sedative in acute, sthenic, or dynamic inflammations. In pneumonia, pleurisy, acute hepatitis, peritonitis, and cerebritis it is valuable as

long as congestion alone is present; later it is not only useless, but harmful. In peritonitis aconite is preferred to veratrum viride on account of the tendency of the latter drug to provoke vomiting, which is harmful. This objection obtains to veratrum viride in cerebritis.

In puerperal fever it has been highly recommended, but must be used with care. In puerperal eclampsia large doses (20 to 30 drops) have been advised; it acts chiefly by its depressant action on the motor tracts of the spinal cord.

In excessive cardiac hypertrophy and in the irritable heart of strong, healthy men veratrum viride is of value.

In aneurism where the disturbance of circulation is great and arterial pressure is high, the drug may be used with great care to diminish the arterial pressure and to prevent rupture of the diseased vessel.

Veratrum viride is contra-indicated in all conditions of depression or exhaustion, and, if vomiting be feared, must not be given in peritonitis or gastritis, as it may cause emesis.

In acute inflammation 1 drop of the tincture may be given, every half-hour or hour, to a healthy adult. In the course of two or three hours or less the skin becomes moist or relaxed, the pulse slower and softer, and slight nausea may be present. These symptoms show that the drug is exerting its influence, and it should be withdrawn.

**VESICAL CALCULUS.** See URINARY SYSTEM, SURGICAL DISEASES OF.

## W

### WOUNDS AND STINGS, VENOMOUS.

#### Insect-bites and stings.

These may be divided into three general classes. In the first may be included

the minute bites and stings of the smaller insects,—the flea, the mosquito, the bed-bug, etc.,—in which the lesions are purely local and of slight importance; in the

second may be placed the stings of bees, hornets, wasps, etc., in which there is considerable local pain and sometimes constitutional manifestations; while in the third may be included the stings or bites of scorpions, centipedes, venomous spiders (the tarantula, for instance), etc., in which severe local and general disturbances may ensue. The more important of these are separately considered below.

**Treatment of Bites and Stings in General.**—While special measures are indicated in some instances, a general foundation for the remedies to be used lies in the fact that the poison introduced into a wound by any insect is strongly acid in nature, and that the local effect is primarily one tending to producing coagulation and agglutination of the corpuscular elements of the blood. Hence the well-known value of ammonia in such cases whether applied in weak solution over the skin, or in strong solution or pure into a wound. Permanganate of potassium in 1- to 5-per-cent. solution is also effective for the same reason. The properties of common salt in saturated solution are well known to every housewife. Common clay or clean mud applied over a wound are favorites among wayfarers.

According to Ottinger (Sem. Méd., p. 250, '96), the best treatment for the bites of venomous insects, of whatever family, consists in covering the part pricked with a thick coating of a mixture of equal parts of ichthyol and lanolin, or, even better, pure ichthyol. In case the insect-bite has already determined the tumefaction of the member, the latter is painted over its entire length with pure ichthyol and covered with a sheet of gutta-percha, on which ice is then applied.

For travelers, soldiers, etc., carbolic acid is an excellent preventive agent, not only against the mosquito, but also one tending to keep off the numerous other

pests—ticks, fleas, lice, horse-flies, etc.—with which practically all countries are infested. The use of a strong carbolic-acid soap for washing purposes suffices when insects are not numerous; in malarial regions, however, especially when mosquitoes are numerous, the protection must be increased in proportion. This can be easily done by dipping the hands, after the ablutions are over, into a bucketful of water containing an ounce of carbolic acid, and passing them, while wet, over the face, neck, and ears,—any portion of the body that may be exposed. If the parts thus moistened are not wiped the water will evaporate, leaving a thin film of carbolic acid over the skin, which thoroughly protects it until completely washed off by the perspiration. If resorted to before retiring, the protection usually lasts during the sleeping-hours. When carbolic acid is not available an emulsion of common kerosene or petroleum is an excellent substitute.

A handful of laurel-leaves boiled in a pint of lard makes an ointment which, applied over the hands and face in insect-infected districts, affords efficient protection.

**Mosquito.**—The blood-sucking mosquito (*Culex anxifer*) is to be found almost everywhere, but exhibits the extremes of virulence on the shores of the Arctic Ocean and in the tropics. The female is the offender, and, after sucking a portion of her victim's blood, replaces it with the poison that leads to the familiar itching, swelling, and, sometimes, to more violent inflammation.

Besides the power of transferring the germ thought to be capable of giving rise to the *Plasmodium malariae*, the mosquito is also a medium for transference to human beings of the *Filaria sanguinis*. Yellow fever has also been included by some observers in the list of



affections which the mosquito may convey by its bite.

**TREATMENT.** — Besides the measures indicated above, aqua ammoniæ, which reduces the suffering if applied with a little rag and left *in situ* a few moments, often proves useful. Menthol sometimes affords considerable relief, the crystalline solid or camphoraceous substance being rubbed over the surface.

To prevent the development of mosquitoes in pools, permanganate of potassium has been recommended. Two and one-half hours are required for a mosquito to develop from its first stage to its active and venomous maturity. The insect in all its phases may be instantly killed by contact with minute quantities of permanganate of potassium. One part of this substance in fifteen hundred of solution distributed in mosquito marshes will render the development of larvæ impossible; a handful of permanganate will oxidize a ten-acre swamp, kill its embryo insects, and keep it free from organic matter for thirty days. An efficacious method is to scatter a few crystals widely apart. A single pinch of potassium permanganate has killed all the germs in a thousand-gallon tank.

In foul, mosquito-breeding pools, the water of which cannot be used, the mosquitoes infesting it, their larvæ, and nymphæ can be easily overcome by pouring into each sheet of water a quantity ranging from a few ounces to a pint of petroleum.

**Bee-, Wasp-, and Hornet- Stings.**—The sting of a bee is barbed at the end, and is, consequently, always left in the wound; that of a wasp is pointed only, so that they can sting more than once. Swelling comes on very rapidly and spreads very quickly. The hornet's sting is the most severe, and the bee's the least.

The wasp, an insect allied to the hornet, is capable of stinging severely also.

The pain of the stings of venomous insects like the bee depends less upon the introduction of the sting into the part than upon that of the venomous fluid. Experiments tend to prove that when the little poison-bag, situated at the base of the sting, has been cut off, a wound with the sting produces no pain. The poison flows from the vesicle through the sting at the instant when this passes into the flesh.

Several stings may cause serious constitutional disturbance. Under such circumstances a stimulant will be first required, after which the sting or stings should be removed with a fine-pointed forceps, or, if they are too deep to be laid hold of, the hollow tube of a small key may be placed over the injured part, so that the puncture shall be in the middle, and by pressing it firmly down the skin be caused to rise in the hollow, when the sting will probably start out, or a watery fluid will escape, carrying with it some of the venom. If a lens is at hand, it will be well to examine each wound, when perhaps the sting may be seen, and it may be extracted with the forceps.

In the treatment of bee-sting ipecacuanha powder made into a paste and smeared over the parts affected prevents, to a large extent, the swelling and pain. George King (*Indian Med. Gaz.; Pract.*, July, '96).

The immunity of bee-keepers from the effects of bee-poison studied. One hundred and twenty-four bee-keepers were immune, 9 of them being naturally so to the sting of bees; 26 could not acquire immunity. The number of bee-stings to produce immunity varied considerably, sometimes 30 being sufficient, but in many cases as many as 100 were necessary. The most favorite means of dealing with bee-stings is spirit of ammonia. A 5-per-cent. solution of permanganate of potash will counteract the poison, and an injection of a 2- to 5-per-cent. solution is recommended. Langer (*Scalpel*, May, '98).

**Wood-tick (Ixodes).**—Blood-sucking ticks of various kinds are common in most countries. In the tropics the so-called *Carapata* is that most frequently met with. They bury the whole head in the flesh, and distend their bodies with blood ere they are discovered, and any ordinary attempt at removal only detaches the latter, leaving the head behind to create trouble.

The head should be removed with needle or knife, and the wound subsequently dressed antiseptically. Turpentine applied to the rear end of the insect sometimes causes it to loosen its hold. Any essential oil, or a drop of chloroform injected with an hypodermic syringe, frequently brings about the same result.

**Jigger.**—An insect that closely resembles the common flea, and that in Cuba and Porto Rico demands to be specially guarded against, is the nigua, chigo, or jigger (*Pulex penetrans*). It is the female only that is annoying, and she is especially apt to work her way beneath the skin at the ankles, or preferably at some part of the foot, most often between the toe-nail and the flesh, but sometimes between the toes. Having buried herself, an intolerable itching results, which, at first is rather agreeable than otherwise, but after a few hours merges into most violent pain. At the same time a small, white, bladder-like tumor about the size of a pea, with a dark spot in the centre, develops under the skin.

The tumor is the rapidly-growing nest, developed from the posterior portion of the body of the chigo, and the black spot is the anterior portion of the little pest.

**TREATMENT.**—To rid the part of the incumbrance, Mexican guides apply a lighted cigarette to the spot, the heat of which penetrates sufficiently to destroy the insect. But a somewhat more del-

icate operation is performed by negro women; with a fine needle they remove the skin from the little ball or nest precisely as one would peel an orange, and then making pressure with the thumbs, succeed in squeezing out the sac of eggs; the cavity is then filled with snuff or tobacco to guard against the possibility of development of any eggs that may accidentally have escaped from the sac and have been left behind. The unacclimated persons and all newcomers are especially subject to the attacks of the chigo. Excruciating, violent inflammation and even gangrene have resulted from neglected chigo-sores.

**Sand-fly.**—The minute sand-fly is more venomous than either the gnat or mosquito. It is most abundant near the water, but, unlike the latter, it does not haunt marshy districts and damp herbage, but rather sandy and ridgy ground. The remedial and preventive measures recommended in the case of mosquitoes are also useful here.

**Vivigagua.**—This is a species of ant that lives in considerable colonies in the West Indies, chiefly in and about the sugar-cane fields. It bites with exceeding fierceness, producing the impression that one has been pierced by a red-hot needle. Unfortunately there is no protection to be had from its onslaughts except carefully burning over the ground before camping or using a liberal sprinkling of insect-powder, or of poke-root and borax mixed.

**Diablito Colorado.**—This is an exceedingly-minute insect which lives in the grass and on shrubs in tropical regions. It is so minute that its presence can hardly be detected with the naked eye. It has several names according to locality, though *diablito colorado* (little red devil) is the prevailing one. Because of its bright-scarlet hue, the French col-



onists term it *bête rouge*. It abounds during the rainy season, and its bite causes intolerable itching, which, as Schomburg expressed it, "by day drives the perspiration from every pore, and at night makes one's hammock resemble the gridiron on which St. Lawrence was roasted." Nevertheless the bites must not on any account be scratched, since if the skin is once broken or abraded a most ugly sore is apt to result that will be very difficult to heal.

**Scorpion.**—Scorpions are peculiar to the tropics and subtropics. They for the most part hide under stones, fallen tree-trunks, in the roof, thatch, and dark corners of deserted huts, and obscure parts of inhabited dwellings; they often take possession, over night, of one's boots, stockings, or trousers. Their weapon is in the tail, and it is used by bringing the latter forward over the back and head; but the creature first endeavors to lay hold of the object it desires to sting with its claws, or lobster-like pincers. The stings of scorpions very rarely prove fatal except in young children. They are not dangerous to persons in good health, though considerable inflammation and swelling may be produced, and even persist for a couple of days, along with slight fever; it is only in rare instances these symptoms present any marked degree of severity. The American varieties of scorpion are much less virulent than their European, African, and Asiatic brethren.

**TREATMENT.**—Scorpion-stings are easily relieved by camphor, rum, lemon-juice, or solution of carbolic acid.

**Centipede.**—A centipede's bite is about as venomous as the sting of the scorpion, and may prove serious in children and persons weakened by excessive fatigue, disease, and the inordinate use of alcohol. Like the scorpion, it is apt to pene-

trate into crevices and other dark places, and it occasionally ensconces itself into the depths of a boot or shoe. Hence the advisability of always shaking out footwear before putting it on in tropical countries. The venomous species may be recognized by the fact that its legs are quite short, and that each segment of the body bears a single pair of legs. The body is usually flattened and brownish yellow, and the antennæ are long and many-jointed. The so-called "centipede" with long legs met with in Northern climates is not the true centipede.

**TREATMENT.**—The treatment of centipede-bites is the same as that of the sting of the scorpion.

**Spiders.**—In the North spiders have a worse reputation than they merit, the bites ascribed to them being inflicted by other insects. In Southern California, which is a semitropical region, so-called spider-bites are ascribable to the pirate-bug (*Rhasahus biguttatus*), according to A. Davidson (Ther. Gaz., Feb., '97).

In the tropics the majority of spiders are not to be classed as poisonous, but their bites seem especially prone to provoke ulcerations that are healed only with the greatest difficulty. The ground and trap-door spiders grow to great size—often the body alone is 2 or 2 1/2 inches in length. They are hairy, most repulsive creatures, living in wells or tubes excavated in the soil, with a trap-door stop which is closed when the tenant is at home. The common trap-door spider is generally known as "tarantula" in Jamaica and Cuba, because of its close resemblance (but generally is of smaller size) to the true tarantula, which is also found, but more sparingly. Both inflict wounds, when opportunity offers, but these wounds are not of the highly poisonous and dangerous nature generally imagined.

**TREATMENT.**—Any of the preparations recommended for mosquito-bites are also useful in spider-bites. In severe cases the local injection of a 5-per-cent. solution of permanganate of potassium may prove advantageous, the patient's strength being simultaneously sustained by means of strychnine and, if need be, stimulants. Strong coffee enjoys great confidence in this particular.

**Horse-fly.**—The so-called "horse-flies," or deer-flies, occasionally attack man, and torture all four-footed creatures in the tropics. All are blood-suckers, and often deposit their larvæ along the spine, where the skin is thinnest, of horses, mules, etc.; one species deposits its eggs in the nose of these creatures. The bites are painful and persistent. Acute inflammation followed by general toxæmia has been observed after these bites in individuals previously weakened by disease or such excessive fatigue as soldiers are exposed to during campaigns. It usually attacks the back of the neck.

The laurel-leaf ointment and the carbolic-acid solution referred to under **TREATMENT OF BITES AND STINGS IN GENERAL** are excellent preventives for man and beast, while the general measures given are also applicable for the treatment of bites.

**Land-leech.**—The Philippine Islands are infested with a blood-thirsty land-leech, most tormenting, but not dangerous, whose attacks in certain districts are not to be avoided except by the use of stout, tight-fitting, canvas leggings. In those of robust health leech-bites amount to little beyond mere annoyance, the difficulty sometimes encountered in stopping the bleeding, slight inflammation, and itching. But in those of degraded habits or in poor health, the punctures, if rubbed or scratched, are

liable to degenerate into ulcers that may lead to loss of limb or life.

**Snake-bites.**—There are over twenty-five species of poisonous snakes in the United States, the most common of which are the rattlesnake, the common viper, the copperhead, and the moccasin. In Northern climates, however, their activity is less marked than in tropical regions, and the bites are comparatively few. Cuba, Porto Rico, and the Philippines also possess a number of varieties, the most virulent, according to Stockwell, being the boaquira, or juba, in Cuba and Porto Rico, and two venomous boas and a variety of viper in the Philippines. The former is described by this author as not more than four or five feet long, and practically, if not specifically, identical with the rattlesnake of Florida. It can generally be recognized by its mode of coiling when about to assume the offensive, and the warning it always gives before striking.

Howard A. Kelly (Johns Hopkins Hospital Bulletin, Dec., '99) recently lectured upon these reptiles and gave the following general distinguishing features:—

The *poisonous snakes* of this country belong (excepting the little harlequin snake) to the group of pit-vipers. The "pit" found in all consists of a depression over the lip between the eye and the nostril. The head of pit-vipers is triangular, with massive muscular development of the jaw. Venomous snakes are thicker in proportion to their length, and their surface appears rough. The pupil is elliptical instead of round.

The *harmless snakes*, on the contrary, are usually slender and smooth. The head is elongated and oval or round. The pupil is round. Among these are many kinds thought venomous, the "orange-bellied moccasin," for instance,



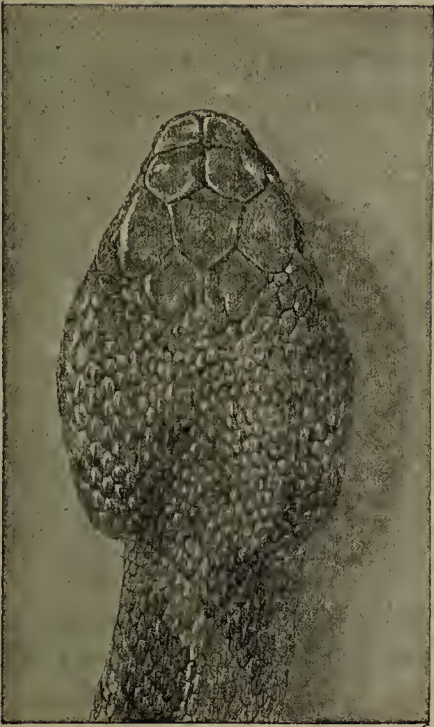


Fig. 1.



Fig. 2.

Figs. 1 and 2.—*Copperhead*: common pit-viper. See pit just behind nostril; oval pupil. Color: light chocolate or lustrous copper, with dark, alternating patches; belly yellowish. Rarely longer than three feet. Vicious, but quantity of venom available less than that of rattlesnake. (Howard A. Kelly, Johns Hopkins Hospital Bulletin.)



Fig. 3.

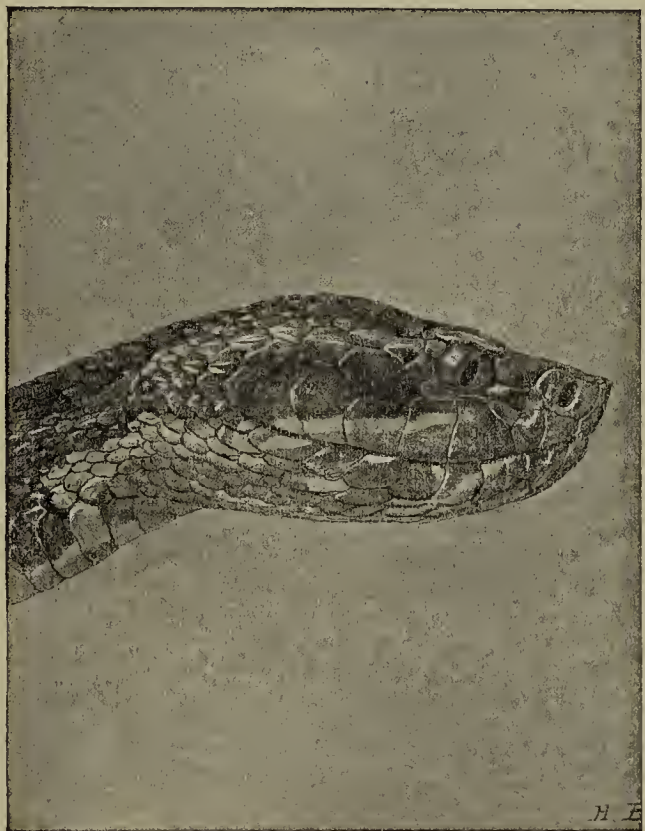


Fig. 4.

Figs. 3 and 4.—*True moccasin*. See pit in front of the eye in Fig. 4 and oval pupil. Dark-greenish brown, sometimes almost black, with slightly darker bars. Broad in proportion to length; triangular head; thick jaw. But one recorded fatality. (Howard A. Kelly, Johns Hopkins Hospital Bulletin.)



which is confused with the true moccasin and needlessly killed. Many of the harmless are useful through the fact that they destroy field-vermin, while others, such as the black-snake, destroy venomous reptiles. (Howard A. Kelly, Johns Hopkins Hospital Bulletin.)

The claim that venomous serpents can always be detected by their broad, flat, lanceolate heads is not to be depended upon, according to Stockwell; but this author also lays stress upon the pit behind the nostrils and the elongated vertical pupil observed in other nocturnal creatures. He states that no venomous

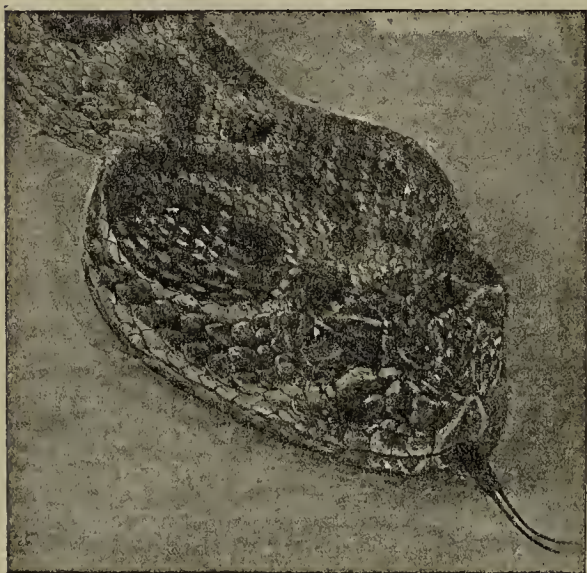


Fig. 5.—*Rattlesnake*, distinguished by caudal "rattle." Note pit below and behind nostril and oval pupil. Diamond-shape or banded markings, which are sometimes obscured by general dark color. Background mottled buff or greenish yellow. Head massive and triangular. (Howard A. Kelly, Johns Hopkins Hospital Bulletin.)

serpent will ever be found in or on a tree; while most have clubbed, instead of slender, tails. Rattlesnakes prefer, as a rule, the more elevated and stony districts. When other evidence is lacking as to the character of the reptile, it may be pinned to the ground by means of a short-forked stick pressed upon the neck immediately behind the head, when the

mouth can be pried open and examined for poison-fangs; commonly, under such circumstances, the fangs will be seen hanging perpendicularly from either side of the forepart of the upper jaw, or they may be directed forward in a horizontal plane, just projecting beneath the upper lip—the position for wounding or striking; besides, if the creature is enraged, minute drops mixed of venom and saliva will be seen exuding and dripping from the fangs. If the serpent is quiescent, these fangs are retracted until they lie horizontally along the upper jaw with their points looking backward.

Though rattlesnakes are dangerous, more so in warm than in more temperate regions, the wounds they inflict are not so universally fatal as popular prejudice would lead people to believe. This is dependent on two causes, viz.: season and habits of life. Their maximum virulence is developed during the hot season, or the period of reproduction. But venomous snakes, with few exceptions, are sluggish, and the poison they possess is given them as a means of securing prey; this poison, consequently, is a powerful paralyzant, and the creature bitten cannot get far away from his would-be devourer. Once a creature is bitten, the major portion of the poison contained in the sacs at the base of the fangs is used up, and it requires hours to reproduce it in any quantity. The second use of the fangs, consequently, does not develop the virulence that obtains to the first; and the third is still less venomous and perhaps not at all so, the fluid exuded by the fangs being merely a secretion analogous to that developed in the salivary glands of man. Even after the fangs are removed the creature sometimes develops a new pair with surprising rapidity, the only safeguard being to destroy the bulb at the root of each of these tiny weapons.



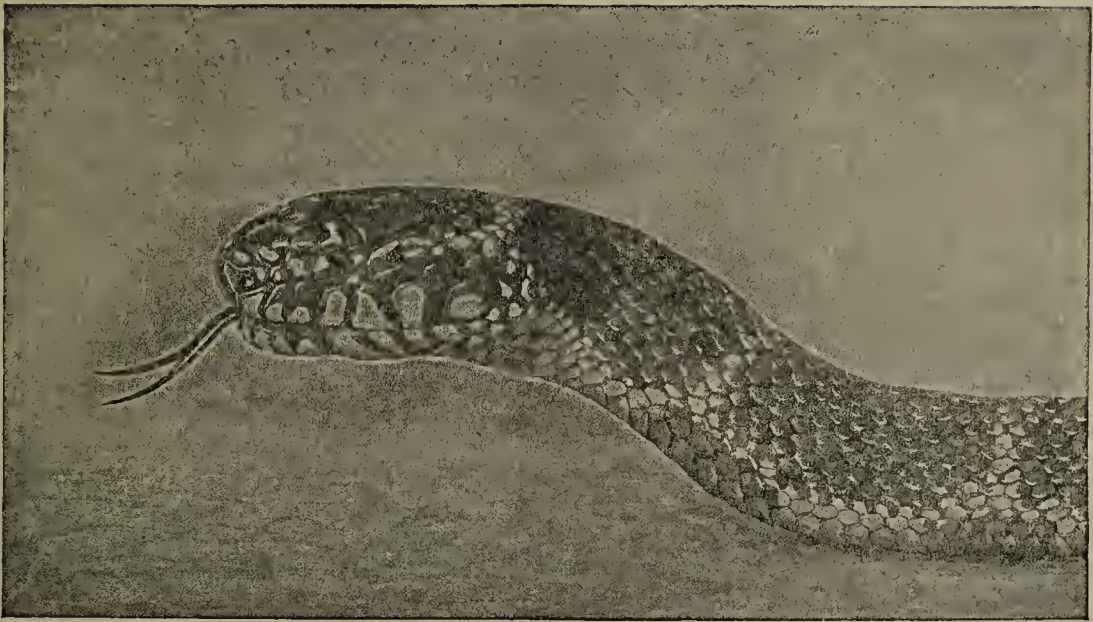


Fig. 6.

Fig. 6.—*Harmless black-snake, or chain-snake*: an enemy of venomous snakes and vermin. Note round pupil, absence of pit, and rounded head. (Howard A. Kelly, Johns Hopkins Hospital Bulletin.)



Fig. 7.



Fig. 8.

Figs. 7 and 8.—*Common water-snake*, erroneously termed "water-moccasin." Note round pupil, absence of pit, and narrow head. Perfectly harmless. (Howard A. Kelly, Johns Hopkins Hospital Bulletin.)

The vipers of the far East are more abundantly supplied with venom than the rattlesnakes, and it is more virulent and more quickly renewed.

Two venomous reptiles, beside a form of boa, inhabit the Philippines—one of the former, fortunately, somewhat rare. This latter frequently attains a length of nine or ten feet, and, unlike poisonous reptiles as a class,—there are but three or four exceptions,—is apt to take the offensive and attack man. One should

its presence, before donning the same in the morning. This viper may be recognized by its club-shaped, or obtusely-pointed, tail.

SYMPTOMS.—The symptoms following snake-bite are similar, whatever be the kind of offending reptile, but they vary in intensity according to the quantity of venom injected and the kind of serpent. But slight pain is at first experienced; this gradually increases, however, until it becomes severe. The tissues sur-

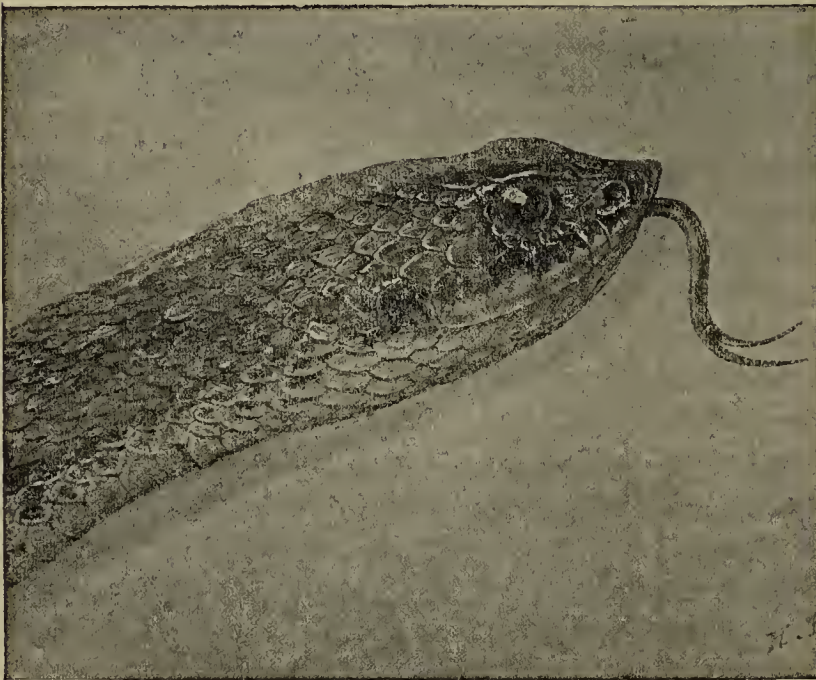


Fig. 9.



Fig. 10.

Figs. 9 and 10.—*Puffing adder*. Harmless; destroys field-vermin. Gentle and easily tamed. When frightened, it swells its head and hisses loudly. Note round pupil and absence of pit. (Howard A. Kelly, Johns Hopkins Hospital Bulletin.)

never flee from it, since then his fate is sealed, but, facing the reptile, attack it with a stick or club, and, fortunately, it is easily dispatched by a slight blow on the neck. The other venomous reptile is a small viper, allied to the *Tic palunga* (or Russels viper) of India, Ceylon, Sumatra, Java, the Malay Peninsula, etc. It is, for the most part, nocturnal in habit, and during the day lies coiled up in some nook beneath thick herbage. It is well to examine boots and clothing for

rounding the wound become infiltrated, swelled, and ecchymotic, and in some cases gangrene follows. The influence of the poison on the centres now appears, the respiration becoming labored, and cardiac action abnormal: *i.e.*, weak and irregular. Cold sweats, faintness, nausea, and vomiting simultaneously appear, and the patient may sink in a few hours from cardiac paralysis. When the case passes safely through the first thirty-six or forty-eight hours, the destructive in-



fluence of the venom upon the protoplasm of the blood-corpuscles and tissues manifests itself by more or less violent mental symptoms or exhaustion and coma. In many cases, however, when the patient is otherwise strong, he slowly recovers. Individuals weakened by disease, overwork, or insufficient food; children, and weak women are those in which the prognosis is unfavorable.

**TREATMENT.**—The first step in the treatment of serpent-bites is to apply a ligature—a tightly-tied and twisted cord or handkerchief—about the bitten limb and above the wound. As the poison exerts its chief effect upon the brain and nervous centres, as evidenced by drowsiness, stupor, and failure of heart and respiration, every effort should be made to combat the two former and sustain the two latter, which is best done by violent exercise, physically enforced if necessary. Suction has often been resorted to; it affords no danger to the person practicing, unless the lips be cracked or the mucous membrane of the mouth be abraded in some way. This being done, the part bitten should be excised, using a penknife if nothing else be at hand; two crescentic incisions meeting at the ends and bottom should be made, and the part allowed to bleed freely. When the skin of the bitten part can be raised between the fingers, it may be pinched up and cut out with scissors. If the bite is found to be deeper than the skin, a small piece of the deeper tissues may also be removed. Cauterization with a hot iron is also advised, but it is quite as painful and less reliable a means. It may be useful, however, if excising instruments, a scalpel or knife, are not at hand and after suction. A piece of thick wire, a darning needle, etc., may be heated red-hot in the flame of a lamp, candle, or of a bundle of matches constantly fed by

new ones and its tip is quickly inserted into the wound until every part of it is well burned. This should only be considered as a temporary means, however, and the part should be excised as soon as at all possible, since absorption is exceedingly rapid.

Chemical destruction of the poison is a possibility, but it is seldom that the required agent is at hand. The best of these are a 5-per-cent. solution of permanganate of potassium and strong ammonia. Either of these may be injected into the wound with an hypodermic syringe.

Subcutaneous injection of a solution of permanganate of potassium both around and into the bite recommended in the treatment of snake-bites. In very poisonous varieties a 5-per-cent. solution may be necessary. In adder-bites Dr. Sallden, a Swedish physician, has found a 1-per-cent. solution sufficient. The injection must be given as soon as possible. Ligation of the bitten limb will retard the absorption of the virus, but not over twenty-five minutes. Lacerda (*Indian Lancet*, July 1, '97).

Nitrate of potassium neutralizes venom of snakes and venomous insects. After sucking the part bitten thoroughly (the poison is not nearly so dangerous in the mouth or stomach as in the wound) and applying a bandage tightly between the wound and the heart, 1 tablespoonful of pulverized saltpeter, dissolved in a glass of water, is given. To a child under ten years, 1 teaspoonful is enough. If the first dose is vomited, the dose is renewed. Either whisky, aromatic spirit of ammonia, ammonia, or sulphuric ether, strychnine, etc., given hypodermically, should be used as stimulant. F. Howard (*St. Louis Med. Era*, Oct., 1900).

Successful use of potassium permanganate in viper poisoning in a boy aged 14 years who was bitten upon the right hand by a viper. Ten hours afterward, while presenting to a marked degree the symptoms of poisoning, two injections of a 1 per cent. solution of potassium permanganate in the site of

the wound; later, intravenous injections at the elbow of the affected side were made. At four-hour intervals hypodermic injections of camphor were given, followed by as much coffee and milk as he could swallow. Recovery was complete on the ninth day. Dott. Antonio Mori (*Gazzetta degli Osped. e delle Clin.*, No. 28, p. 298, 1904).

Cardiac stimulants, digitalis and alcohol, by the mouth are important adjuvants, but their stimulating effects are not obtained with large doses, as is well known. A tablespoonful of whisky or brandy and 10 drops of tincture of digitalis in a half-glassful of hot water is an excellent means to sustain the heart's action, the pulse being the guide.

It has long been known that the bile of venomous serpents was a powerful antidote to the venom. It is now, however, the rule, according to Fraser, that the bile of any particular species is most efficient against its own venom; thus, the bile of the crotalus and several other species is more efficient against cobra-venom than that of the cobra itself. If, instead of venom, the toxins of infectious disease be employed, it is found that the bile is a more or less efficient antitoxin. This quality is shared, however, by the bile of rabbits, and to a less degree by that of many other animals. As toxins and venom are excreted by the intestinal tract, the bile is most favorably situated for acting upon them, and remedies, therefore, stimulating hepatic secretion should increase the resistance of the animal. Moreover, toxins introduced into or generated in the intestinal tract are those neutralized. It is probable that the particular constituent is, in part, antitoxin or antivenom that has been eliminated from the blood into the bile. Calmette, on the other hand, considers that the active principle in the venom of all snakes and other poisonous reptiles, lizards, scorpions, etc., is a

serum common to all, which would immunize, therefore, against all these alike.

The antivenomous serum personally discovered and prepared. It antagonizes the action of all venomous poisons, and the reason certain others have not secured results equally as good is that they have not taken into full account the difference in weight between the animals experimented upon, and have therefore not used the serum in doses proportionate to the weights and resisting power of the animals employed. In spite of adverse criticism it is maintained that the serum of an animal hypervaccinated against a very active venom can, when injected in a sufficient quantity, prevent the death of an animal inoculated with fatal doses of venom of other serpents. Calmette (*Brit. Med. Jour.*, May 14, '98).

Report of several cases of snake-bite treated with antivenene, with recovery. In the case of a boy, aged 12 years, for instance, bitten in the finger in the early morning by a krait, most acute symptoms supervened, including protrusion of the eyeballs, ptosis of both eyelids, and œdema of the glottis. The patient soon sank into a state of lethargy and collapse, and his condition was apparently hopeless. Twelve cubic centimetres of Calmette's antivenene were injected hypodermically, also  $\frac{1}{60}$  grain of strychnine. Enemata of brandy and beef-tea were administered, and artificial respiration was kept up for half an hour. From this period onward recovery was rapid and uninterrupted. The œdema, paralysis, and blindness disappeared in forty-eight hours, but diplopia of the left eye persisted for several days. Editorial (*Indian Med. Record*, Jan. 10, 1900).

Experiments on dogs in order to test the efficacy of antivenene against the bite of the black Indian cobra. Though the antivenene was injected immediately after the bite, in no case was there the least benefit noted. As soon as the cobra poison began to act, the symptoms followed in the same regular sequence till death, controls and injected dogs dying alike within an hour. Carr-White (*Indian Med. Gaz.*, Nov., 1902).



**WOUNDS (SEPTIC) AND GANGRENE.****Septicæmia.**

**Definition.**—Septicæmia is an acute febrile affection characterized by marked nervous, cutaneous, and visceral manifestations, and due to the introduction into the system of bacteria or their toxins, or both, derived from an infected wound.

**Varieties.**—There are two varieties of septicæmia: *true septicæmia*, in which micro-organisms, especially bacilli and micrococci, penetrate into the blood and there multiply; and *sapræmia* in which the toxins or ptomaines alone of the pathogenic organisms enter the system and cause chemical poisoning. Both varieties often exist simultaneously.

**Sapræmia.**—The symptoms of sapræmia are those of poisoning by a chemical agent. The disease sometimes begins with a chill, soon followed by a marked rise in the temperature; but in most cases the latter is the first evidence of the disease. The skin becomes cold and clammy; there is marked prostration and sometimes diarrhœa. When these manifestations occur while a wound is present, they are ominous, and the dangerous complication can often be avoided if the dressing of the wound is renewed and perfect antiseptic precautions are taken to thoroughly remove all septic matter from its surface. The constitutional symptoms often disappear of their own accord, when this is done, if the systemic infection is not already sufficiently advanced to thwart all endeavors.

Wounds that are undergoing putrefactive changes and free from healthy granulations usually represent the foci of infection under such circumstances. The disease is also caused when an exposed surface such as that of the uterine cavity is exposed to the effects of a putrefy-

ing placenta or clots. (See ECLAMPSIA.) Psoas abscesses or gangrenous wounds, peritoneal injuries, accumulations in the peritoneal cavity of blood-clots, and insufficiently-drained wounds represent the conditions which may give rise to sapræmia.

The general poisoning induced as a result of the absorption of toxins in such acute infectious diseases as diphtheria, typhoid fever, etc., in which foci of infection occur, owes its origin to the latter also, through the absorption of toxins. The ingestion of poisonous foods, putrid meat, or other organic matter is also productive of a form of sapræmia.

**True Septicæmia.**—In this condition, as stated, the septic infection is due to the presence of bacilli or micrococci in the blood. The invasion is more gradual and the symptoms develop less rapidly. Fever, headache, vomiting, diarrhœa, anorexia, great prostration, and mental torpidity—in a word, a general typhoid condition—constitute the array of symptoms witnessed when septicæmia is developing after an injury or surgical operation.

The fever is of the continued type and gradually increases, the temperature becoming suddenly raised when a period of danger is reached. In rare cases, however, fever is absent, and, when the abdomen is the seat of the injury (gunshot wounds, hernia, etc.), the temperature may even be subnormal. The pulse may be strong and rapid at first, but it gradually fails in power until it becomes easily compressible and weak, though very rapid. After abdominal lesions the pulse may remain extremely rapid, while the temperature is subnormal.

In a certain number of abdominal operations patients die of acute peritoneal septicæmia. The serious symptoms develop within twelve hours after operation, and death occurs within thirty-six

hours. Lesions found after death are dilatation of coil of intestines and fine arborescent vascularity of the peritoneal coat. The peritoneum may be dull, and a little sero-sanguinolent fluid is found in Douglas's pouch. Fatty degeneration of the liver-cells is found, commencing around each portal canal, and later spreads toward the centre of the lobule. Clinically these hepatic lesions are usually manifested by an icteric tinge of the skin (Jayle). One of the most striking symptoms is rapidity of the pulse, often without a corresponding rise of temperature. Hartmann (*Annals de Gynéc.*, Feb., '96).

Diarrhœa is frequently observed, but it is seldom as violent as in cases in which the general toxæmia is due to the ingestion of toxic foods. It is but a manifestation of the gastro-enteritis which attends the majority of cases. Vomiting also occurs, but is rarely severe. The spleen is enlarged in most cases; indeed, all the lymphatic glands show a marked tendency to become infiltrated and enlarged. The urine usually shows considerable albumin and casts.

The blood undergoes rapid deterioration, owing to the presence in the blood of micrococci. As a result, the skin becomes pale and yellowish, and shows a punctate eruption—minute areas of cutaneous hæmorrhages—sufficiently like that of scarlatina as to suggest the presence of the latter disease. Other cutaneous manifestations may also be witnessed and present analogies to those occurring in connection with other diseases, roseola, herpes, superficial œdema, etc. At first the skin is hot, dry, and rough; gradually it becomes doughy, bathed in perspiration, and often cold and clammy. Often a yellowish tinge suggests icterus; this is less marked, however, than in pyæmia.

Toward the later stages, complications may develop. Endocarditis may occur,

and, its appearance being very insidious, is sometimes far advanced when discovered, the physical signs being less marked than is usually the case in this disease. Gradually the sallow hue of the skin deepens, the mental torpor lapses into stupor, and dulling of the senses becomes perceptible in every way. The tongue becomes dry and thickly furred; the urine, at first scanty, becomes concentrated and sometimes has to be drawn with the catheter. Delirium is replaced by coma, soon followed by death.

The local manifestations vary; indeed, none may appear. This is especially the case when the disease runs a very acute course. On the other hand, a severe local inflammatory process may develop, accompanied by sloughing and rapidly spreading gangrene. This is frequently observed in connection with slight injuries, such as those to which surgeons are exposed. In such cases the wounded finger becomes inflamed and painful, red streaks appear on the arm, and the lymphatic glands of the member swell. Prompt measures may even here arrest the process or general toxæmia follows.

In accidents involving crushing the general septicæmia may follow contamination from the dead tissues, traumatic gangrene with putrefactive inflammation of the neighboring uninjured tissues ensuing. Moist gangrene, the rapidly-spreading gangrene (*gangrène foudroyante*, with evolution of gas), may thus act as foci which rapidly bring on death. There is great swelling, with local emphysema with crackling sounds, the mass giving off a very foul odor. The mass of tissue becomes totally decomposed if the patient lives long enough. Fortunately antiseptic methods have greatly limited the number of such cases, and they are now rarely met with.

Some cases are atypical. Some, as



stated, run their course without fever; others progress in the usual way and then cease,—the abortive form,—even after the temperature has approximated 103° F. Such cases are not rare.

Attention called to the existence among children, of from four to eight years of age, of a form of gastro-enteritis which has exactly the course and gravity of a cholera infantum. It follows sometimes the ingestion of food bad in quality or improper for the age of the child, sometimes without known cause. It begins as a febrile indigestion, but suddenly diarrhœa begins, vomiting becomes uncontrollable, the facies of cholera appears, and the child dies in three or four days. Fever may be wanting from the beginning. Comby (*Méd. Mod.*, p. 689, Nov. 11, '96).

**Etiology.**—Any wound, no matter how diminutive, may become the starting-point of septicæmia. Hence the comparative frequency of this disease among surgeons who, through a scratch, a slight abrasion, or a post-mortem wound, due to a slight prick of the scalpel used, etc., introduce the virus into their organism. Healthy granulations were thought to be impermeable to toxic elements, but the experiments of Maas and Hack have shown this conclusion to be incorrect.

To affirm that the multiplication of bacteria through general infection is alone capable of causing septicæmia is not warranted by our present knowledge. Toxins here, as in sapræmia, may, in addition to the rapid development of bacteria, act as a potent life-paralyzant. Indeed, experimental evidence tends to show, in the case of animals at least, that such is the case. Koch attributes the disease to a special coccus, Rosenbach to streptococci and staphylococci combined, and Besser to streptococci alone. It is probable, however, that a sharp line cannot here be drawn, since many instances are distinctly combined infections. A mixed infection is commonly observed in

various diseases: in diphtheria, for instance. In some cases no trace of local infection can be found. The subject may or may not be in bad health, and general septicæmia develops and runs its regular course. Osler alludes to 21 such cases, 13 of which are due to streptococcus pyogenes, 2 to staphylococcus pyogenes, and 6 to pneumococcus. In 19 of these, however, the subjects were suffering from other diseases which were complicated with septicæmia. This is the *cryptogenetic* form of Leube. Cases due to bacillus pyocyaneus have also been described.

The micrococcus tetragenus of Gaffky is capable of causing general infections in man, as has been previously suspected from its pathogenicity in animals. Chauffard and Ramond (*Archives de Méd. Expér.*, May, '96).

Case of septicæmia arising from tertiary syphilitic lesions. The so-called cases of "syphilitic cachexia" are similar, and should be called "secondary invasion of the organism by germs developed in syphilitic ulcerations." Quinine and salicylate of soda fail to act on the secondary septicæmia, but there is immediate improvement of this secondary condition when the primary cause is treated by antisyphilitic remedies. Surmont and Patoir (*L'Echo Méd. du Nord*, July 12, '97).

In eighteen cases of pyæmia and sepsis the so-called glycogen-reaction in the leucocytes of the blood noted. Experiments made to determine whether the appearance of the substance in the leucocytes is due to infiltration or to degeneration, and conclusion is reached that it is due to latter process. Kaminer (*Berl. klin. Woch.*, Feb. 6, '99).

**Pathology.**—The most prominent morbid change is in the blood, which is thin and tar-like, in many cases acid, and frequently found to contain a large number of micro-organisms. The gastro-intestinal tract shows evidences of catarrhal inflammation, the mucous membrane being mottled and studded

with hæmorrhagic areas varying in size and number. The lymphatic glands are usually more or less enlarged, the spleen likewise. Apart from these changes, there is little to attract attention. The kidneys are enlarged, the parenchyma is cloudy, the uriniferous tubules are inflamed, and their vessels contain pathogenic bacteria.

The changes in the blood are mainly due to the disintegration of the white corpuscles, and to a certain extent of the red through the influence of the toxins or of that of the micro-organisms themselves. These may be found in the remaining leucocytes, and so crowded are they sometimes that the corpuscles practically become masses of bacteria.

**Prognosis.**—The prognosis of septicæmia depends greatly upon the powers of resistance of the patient and the kind of micro-organism present. According to Settman (Münch. med. Woch., Jan. 15, '95), the most favorable prognosis can be established when staphylococci are found, less favorable if pneumococci are obtained, and least favorable if streptococci are present or in mixed infection. The bacteriological examination of the blood will furnish, in cryptogenetic septicopyæmia, the source of infection. Thus, if we find pneumococci, the lungs are to be looked upon as the source of infection; if the bacterium coli, the intestines, biliary passages, or a cystitis.

When the source of infection—a large septic mass or an infecting surface, etc.—can be reached and judiciously treated, the chances are greatly improved and the symptoms sometimes improve immediately. This is especially the case in sapræmia; but, as it is always difficult to ascertain whether we are dealing with this form or the septicæmia, the information obtainable on this score is rather scant. The rapidity of the

course affords some idea of the chances the patient has, and the prognosis may be said to be favorable if the symptoms show but slow aggravation. The rapid forms of septicæmia are invariably mortal. Important is the fact, already stated, that cases of “abortive” septicæmia are often met with, the symptoms receding after a short period of progress. In septicæmia occurring as a complication of cœliotomy the chances of recovery are very slight.

**Treatment.**—The proper observance of antiseptic surgery under all circumstances, whether the surgeon be dealing with a simple or severe wound, has remarkably diminished the cases of septicæmia. As soon as fever attends an injury or an operation, nowadays, suspicion is immediately aroused that a septic condition of the exposed surface has appeared. The sooner the wound is carefully examined and rendered absolutely aseptic, the better. This is best effected by means of a bichloride solution 1 to 1000, after carefully clearing of any discharge or blood that may be present. In injuries of the extremity, the latter may be left in a bath of borate of sodium, 20 grains to the ounce, for several hours, if need be, after clearing and disinfecting the wound. Stitches should be removed in order to reach every sinus or cavity that may serve as a *nidus* for infectious agents. When a cavity cannot be reached conveniently, a syringe may be employed to wash it out. These measures are often sufficient in sapræmia to arrest at once the process; in septicæmia the result depends upon the promptness with which they are carried out.

To disinfect a wound thoroughly after infection has occurred requires a drug that will penetrate the deeper layers of the infected tissue. This power is found in tincture of iodine. When the tincture



is applied liberally over the carefully dried wound surface, fifteen minutes afterward the tissues show evidence of permeation, and no cultures can be obtained from such areas. If the bacteria are not destroyed, the soil is rendered unfavorable to their further development. No general disturbance observed in the large number of patients on whom the iodine treatment was tried. Beck (Medical Record, Aug. 3, 1901).

If the dangerous, though apparently insignificant, wounds to which surgeons or anatomists are exposed were immediately treated as if they were snake-bites and thoroughly cauterized in the manner recommended in the last article much suffering would be saved them.

Amputation for infected wounds when there are symptoms of septicæmia is useless. All punctured or lacerated wounds should be treated with moist aseptic or antiseptic bandages in order to allow free egress to any germs that may have entered. In case of actually developed phlegmonous infection, deep, broad incisions are required. There is no such thing as local sepsis without participation of the whole organism. Amputation should only be considered for parts that have become gangrenous. H. Dörfler (Münchener med. Wochen., Apr. 23 and 30, 1901).

Case of blood poisoning attended by phlegmonous infiltration of the entire arm, extending to the shoulder, with areas of circumscribed gangrene. Free incisions permitted the evacuation of a considerable quantity of pus; the spread of the inflammation ceased, and the patient finally recovered with good use of the arm except where a scar, as the result of the gangrene, slightly limited the extension at the elbow. Schmidt (Münchener med. Wochen., May 21, 1901).

The medical treatment is of little avail; indeed, remedies tend more to debilitate the patient than otherwise. Important, however, is the use of heart-tonics, especially alcohol and digitalis, strychnine, and nutritious diet—all

agents calculated to antagonize the general adynamia.

Several cases of septic disease of the adnexa reported in which subcutaneous injections of saline solution were administered before and soon after operation, in quantities varying from 200 to 500 grammes. Injections of artificial serum possess great value in cases of general septic infection, especially at the onset of the disease. The circulation is regulated, the heart-action increased, and the cerebro-spinal system and nutritive functions are stimulated. Diuresis is increased within a few hours, but no appreciable amount of toxic matter is eliminated. Improvement in the general condition is to be ascribed to dilution of the toxins in the blood. This process of dilution should be continued as long as fresh toxins develop, by the gradual injection of moderate quantities of saline solution.

Intravenous injections should be reserved for cases in which a very rapid action is necessary. Mangin and Raynaud (Wratch, No. 26, '97).

In septicæmia: 1. The yeast-nucleinic acid should be given at the earliest possible moment that septic infection is suspected. 2. The nuclein should always, in septicæmia at least, be given hypodermically if possible. If the 1-per-cent. solution is used, at least from 30 to 40 minims, undiluted, may be given every three or four hours. If the 5-per-cent. solution should be used, from 10 to 15 minims may be given every three or four hours, but ought to be diluted with distilled or at least with sterile water. 3. The injection region should be examined daily in order to determine if local action can have anything to do with the patient's increased temperature and pulse-rate. If it has, it is due to one of two things: either to insufficient dilution of the 5-per-cent. nuclein solution or to imperfect preparation of the skin or syringe. Walter Courtney (Med. News, Sept. 25, '97).

Method of rectal injection of salt solution recommended by Hegar, which is as follows: The cannula introduced into the rectum is supplied by a receptacle filled with the fluid to be injected, and this fluid is allowed to flow into the

bowel very slowly under very slight pressure until the patient is sensible of a certain amount of tension; the receptacle is then lowered so as to cause part of the injected fluid to flow back into it; this process is repeated, the liquid being changed after a time if it is soiled by fæcal matter. As soon as the rectum has been sufficiently cleansed, absorption by the mucosa commences to the extent of 500 to 1000 cubic centimetres an hour; this is soon followed by more or less profuse diuresis, the relief of the thirst and parched mucous membrane, and by abundant perspiration, which, unlike many critical sweats, is not accompanied by collapse or any distressing symptom, even though the temperature sinks to normal. Vernitz (*Semaine Méd.*; *Brit. Gynæc. Jour.*, May, 1902).

The conclusions drawn from purely clinical observations on a considerable number of septic wounds are as follows: Dry sterile gauze dressings are far preferable for the dressing of septic wounds because they, by their greater power of absorption, most efficiently drain the wound, and by their slight mechanical irritation and comparative dryness make the granulations more active and allow full advantage to be taken of nature's reparative power, while moist dressings and antiseptic baths and irrigating fluids have a depressing effect on the granulations; moist dressings are, however, indicated when one cannot obtain sterile dressings or cannot depend on the aseptic skill of the persons who are to apply the dressings. "Antiseptic poultices" are not to be preferred to sterile dressings, and there is at times a danger in their use; in case irrigating fluids are necessary, when from some unusual reason it is impossible to make a wound of such shape that it can be properly dressed, sterile salt solution should be the irrigating fluid used. Peroxide of hydrogen should be avoided, since in particularly closed cavities or loose tissues its gas production may make it a spreader of infection; the use of dry sterile gauze meets the indications in the routine treatment of the great majority of septic wounds better

than any other material. A. L. Chute (*Boston Medical and Surgical Journal*, April 21, 1904).

### Pyæmia.

**Definition.**—An intermittent febrile disease characterized by the formation of multiple metastatic abscesses in various parts of the system, and due to the absorption of pyogenic organisms.

**Symptoms.**—Since antiseptic methods have been generally used in surgery, pyæmia has greatly decreased. The cases seen in practice are usually due to careless dressing of wounds, generally by the patient himself, who only applies for treatment after the symptoms of general infection are well marked.

The initial symptoms, a chill more or less marked, slight fever, increased sensitiveness of the wound, usually come on a week or ten days after the injury was received: *i.e.*, when suppuration has been fully established. After this first chill, a period of quiescence occurs of perhaps an entire day and, as a rule, another chill occurs the second day, followed by another on the third, and so on, until the chill is observed to be irregularly periodical or intermittent: a characteristic manifestation of pyæmia. The same irregular intermittence is observable in the temperature-curve, which, after marked elevation,—104° F.,—suddenly falls to the normal or even below, remaining there until the next exacerbation. The intermissions vary in length—sufficiently long sometimes to suggest recovery. Suddenly another occurs, and another period of high temperature supervenes. The pulse does not follow the temperature; though its rapidity is increased when there is pyrexia, it is never normal as long as pyæmic infection is present.

The second period is that during which metastatic abscesses are formed. The lungs, the spleen, the liver, and the



kidneys are the sites of predilection for these abscesses, the first two organs especially. A sharp pain in the side with dyspnœa—the attending signs roughly suggesting pleurisy, hæmoptysis, etc.—denotes that the lung has become the seat of the abscess, with perhaps septic effusion into the pleura. If the liver be invaded, jaundice, a common symptom in pyæmia, becomes marked, and the physical signs indicate hepatic involvement. Hæmaturia, the presence of many casts and much albumin in the urine, points to pyæmic nephritis. The brain may also be the seat of abscess, and show signs corresponding with the region involved. The joints are not infrequently the seat of abscesses, and the parotid gland also.

The general symptoms are characteristic and unlike those of septicæmia. The mental condition, unless a brain-abscess develops, is totally different; instead of apathy, there is usually clear perception of suffering, which may become quite severe through the involvement of nerves and joints in the inflammatory process. The skin is usually dark or yellowish and erythematous, and sometimes pustular eruptions may greatly increase the discomfort. The tongue is thickly furred. Marked weakness, emaciation, and exhaustion are the rule, especially in cases of long duration. In the later stages delirium may appear, especially in acute cases; followed by coma.

**Etiology and Pathology.**—Pyæmia has been found by Koch to be due mainly to chain-like cocci, which cause the blood-corpuscles to become agglutinated in masses, which then form thrombi. On the other hand, staphylococci and streptococci have also been found capable of inducing metastatic abscess. The barrier between septicæmia and pyæmia,

therefore, is not, to say the least, solidly established, and many authors now combine the two conditions under the name “septicopyæmia.” Ogston has shown, however, that the cocci more readily enter the circulation, whereas streptococci and staphylococci, even when present through a septic state of the wound, only penetrate the barrier of granulation tissue when in great numbers.

The chain-cocci enter the circulation, especially the veins, and, meeting here and there suitable surfaces, roughened, perhaps, through slight fibrosis, etc., form parietal thrombi of agglutinated corpuscles and cause local inflammation and suppuration of the vascular walls. From these preliminary foci more or less large suppurating thrombi are swept away by the blood-current, and, being thus transported to distant organs, there originate purulent processes. The toxins of sapræmia or the micro-organisms of septicæmia when present are complicating features. The lymphatic system may also act as a channel for the transportation of cocci-laden thrombi.

The micro-organisms are to be found, not only in the white corpuscles, but also in the plasma and where metastatic abscesses have been formed,—in the lungs, pleura, pericardium, endocardium, the spleen, the kidneys, the brain, the joints, etc.,—a feature of the disease which explains the great variety of symptoms witnessed.

The wound usually has a characteristic appearance and odor. It appears grayish, greenish, or black. The surrounding veins are often found to contain suppurating thrombi, which in advanced cases may occupy the whole length of the venous trunk involved. In the joints the synovial membrane is at first merely congested, then suppuration ensues; as in other forms of ar-

thrititis, the knee is a preferred site in pyæmia, the shoulder being next in order.

Five cases of suppuration of the bronchial lymph-glands in pyæmia. Three occurred in young girls, and ended fatally in a few days, with the symptoms of a purulent meningitis. Autopsy revealed multiple cranial abscesses in all three patients, with perforation and subsequent meningitis in two of the cases. In each case the infection started from a suppurating bronchial gland, under the bifurcation of the trachea, opposite the right bronchus. The infection entered from the œsophagus. All three cases were probably tuberculous. F. Schlagenhauser (Wiener klin. Wochen., June 6, 1901).

**Prognosis.**—The course of the disease varies greatly, and it may last from a week to several months. The prognosis of the disease is very unfavorable, however, and but a small proportion of cases recover. When the intervals between the chills are short and the metastases are numerous or involve important organs, the likelihood of an early fatal ending is great. The disease is often linked with septicæmia, the manifestations of both forms being mingled, and the progress of the case toward a fatal ending is correspondingly hastened. Erysipelas has also been observed as an accompaniment of pyæmia, and also reduces the slight chances of recovery.

In the form of pyæmia attending gonorrhœa the morbid processes caused by the gonococcus do not vary greatly from those caused by pus-cocci. E. Finger (Wiener med. Woch., p. 248, '96) found that the behavior of the gonococci in and toward the affected tissues, however, differs from that of the pus-cocci, in that the latter rapidly permeate the tissues and cause rapid breaking down of the same, while the gonococcus is less active and takes only paths of least resistance through the fis-

tures and lacunæ of the epithelium and connective tissue. Again, the reaction of the tissues is somewhat different. The inflammation caused by the gonococcus is entirely purulent; the formation of granulation tissue is early and abundant. The gonorrhœal process tends to the formation of connective tissue and scars,—in the urethra as stricture, in the prostate as destruction of the gland, in the suprarenals as thickening of the organs, and in the joints as ankylosis. Finally, the gonococcus is destroyed when exposed to a temperature of 103° or 104° F. for several hours, while the pus-cocci are far less susceptible to such a temperature. From these considerations it follows that the gonococcus is less energetic in its action and is more easily destroyed than the pus-cocci, and that the lesions produced by the former tend to run toward recovery more readily than those produced by the latter.

**Treatment.**—The primary indications here are precisely those enumerated under septicæmia. More can be done, however, if the case is seen early. The thrombi being transported by the venous current and the early venous abscesses beginning close to the infectious wound, disinfection of the interior of the proximate part of the veins may arrest further progress. A solution of mercuric bichloride, 1 to 2000, may be used for this purpose. If this cannot be done, a ligature may be placed around the suspected vessel some distance above. Amputation performed early sometimes saves the case; it is fully warranted when the diagnosis is positive and the course of the disease is unfavorable. The medicinal and dietetic treatment is that outlined under SEPTICÆMIA.

An important measure in pyæmia is the prevention of bed-sores, which read-



ily form when the patient is allowed to remain in bed. He should be placed on air- or water- cushions; his position should frequently be changed, and the parts compressed should often be bathed with camphorated alcohol. Such a case is a source of infection for wounds in other patients, and should therefore be isolated—preferably in a tent exposed to the sun's rays and allowing a free circulation of air.

### Gangrene.

**Definition.**—This term is usually attributed to death or mortification of soft tissues, while the term “necrosis” is reserved for death of osseous or cartilaginous tissues.

**Varieties.**—Gangrene is divisible into several varieties: *moist gangrene*, due to arrest of the vascular supply, and in which the parts are soft and pulpy; *dry*, or *senile gangrene*, or mummification occurring in old age, in which the tissues become leather-like and wrinkled; *spontaneous gangrene*, a relatively rare form affecting the extremities and observed in apparently strong and young subjects; *ergot gangrene*, which occurs in individuals who, in consuming rye or rye-bread, become exposed to ergot of rye; *diabetic gangrene*, which occurs as a complication of advanced diabetes; *pressure gangrene*, due to pressure and which occurs occasionally as a complication of bed-sores; and *symmetrical gangrene*, or Raynaud's disease, a paroxysmal form affecting mainly the tips of the fingers and toes.

**Symptoms.**—The symptoms vary greatly according to the primary pathogenic factor and to a degree upon the location of the gangrenous process.

**MOIST GANGRENE.**—This variety is that most frequently met, owing to its frequent occurrence as a result of accidents, irreducible hernia, etc. Being due to arrest of the blood, both in the

arteries and veins, there is softening, or liquefaction. The tissues assume various shades, varying from bluish green, red, to black; and blebs containing a very foul and foetid liquid are formed, the mortifying tissues giving off gases composed mainly of sulphide of hydrogen, ammonia, and volatile fatty acids. This form is likely to occur after severe injuries, such as crushing, burning, or even frost-bite. It is also observed when open wounds have been exposed to infection through imperfect or uncleanly dressings. A form of moist gangrene, also of traumatic origin, is sometimes witnessed after a large vascular trunk has been destroyed, which may spread with great rapidity.

In an average case the gangrenous area undergoes, as stated, a characteristic change of color. At first the boundary-line between the dead tissues and the living ones is imperfectly marked. Where the progress of the necrotic process is arrested, however, through the vital resistance of the tissues, an area of inflammation interposes itself as a protecting wall, which becomes more or less perfect as the granulation tissue formed is healthy. This constitutes the *line of demarkation*. The inflammatory process continuing beyond, suppuration ensues, and the dead tissues may thus be entirely separated from the living ones through Nature's efforts. The inflamed area is distinguishable from the healthy or gangrenous ones by its bright-red color, which changes to blue or black in the direction of the dead tissues. Unfortunately Nature's efforts do not always succeed, and the morbid process may penetrate the limiting barrier, and invade the tissues beyond, extending gradually until death ensues.

A green color is not always indicative of gangrene of the intestine. Case of eight-day incarcerated-hernia loop in

which a "fine-green Florentine-bronze color" had appeared. The loop was not reduced and the patient died four hours later, when tests of the green portion proved that it was not gangrenous. The portion of the intestine was filled with water at a strong pressure, and only an apparently sound part split. The intestine can be colored green with bile alone, and a light-green color does not necessarily imply any alteration in the intestinal wall. A yellow-green, dark, black, or bottle-green are of worse significance, but at the same time they do not necessarily indicate a serious deterioration in the intestinal wall. Begoin (Centralb. f. Chir., Dec. 2, '98).

The constitutional symptoms depend upon the amount of tissue involved. At first when an extremity is affected there may be but slight general disturbance; when, however, the gangrene ascends the limb, fever and other evidences of toxæmia appear.

The extension of gangrene depends to a great degree upon the nature of the cause and the general health of the patient. An injury, which, through interruption of the circulation, is followed by gangrene, often remains circumscribed to the region in which the blood-flow has been reduced or arrested, provided, however, the general condition of the patient is favorable. Persons in poor health, or individuals who have lowered their vital powers by the excessive use of alcohol, overwork, insufficient food, etc., however, are much more exposed to extension of the gangrenous process.

Complications incident upon the destructive nature of gangrene usually lie behind a fatal issue, when this occurs. An artery may be eroded, giving rise to mortal hæmorrhage; pyæmia and septicæmia through penetration into the blood of pyogenic micro-organisms or their toxins, peritonitis through extension of the gangrenous process from a

gangrenous hernia, etc., may be mentioned among the many death-producing conditions which can appear.

In the cases previously alluded to, in which gangrene spreads with great rapidity, the so-called *traumatic gangrene*, the blood-supply is not only interrupted, from an extremity, but there is septic infection besides. In a few hours in such cases the gangrene may have spread up an entire extremity through the agency of infectious bacteria. The skin becomes brownish red, black, or green; gas is rapidly formed, and the patient quickly succumbs to acute septicæmia, unless amputation has promptly relieved him of the source of infection. The term "traumatic" is inapplicable to such cases, because it implies that this virulent form of the disease is to be expected after traumatism.

The characteristic by which traumatic gangrene is most readily recognized is the subcutaneous development of gas. W. Evans (Lancet, Jan. 22, '98).

In truth, gangrene seldom occurs nowadays owing to modern methods, and, even in severe injuries of an extremity witnessed in the average hospital case, separation of the dead tissues soon occurs. Strict antisepsis in all surgical procedures adopted greatly limits the likelihood that a dangerous form of gangrene will appear. Yet even slight exposure of a wound to infection may be followed in suitable environment by an active necrotic process endangering the life of the patient.

In DRY GANGRENE, of which senile gangrene is a type, there is a distinct absence of fluids, and the process of mortification is more a metamorphosis into an inorganic mass than a true decomposition; hence the term "mummification" frequently applied to this form. The local blood-supply gradually diminishes, the tissues shrink, become



dark brown or black, wrinkled, and the skin becomes leathery. It usually affects the toes, sometimes the fingers, and may spread to the plantar or palmar surfaces.

Remarkable case of twin labor described where one twin was flattened and macerated, while the other had gangrene of the leg from constriction.

Though the infant lived but sixty-five hours, all the more prominent symptoms of dry gangrene became well established. Stolz (*Wiener klin. Woch.*, Jan. 6, '98).

SPONTANEOUS GANGRENE is rarely observed. It may be met with in subjects who apparently are in excellent health, but affected, as autopsies have shown, by arteriosclerosis. The arteries are narrowed, and thrombi are sometimes widely disseminated through the affected limb. This renders spontaneous gangrene particularly malignant, and amputation of the limb is often necessary, preferably above the knee. Unlike other varieties, it gives rise to acute suffering, owing to involvement of the local nervous supply, the principal branches of which are often found greatly thickened. Spontaneous resolution is rarely observed in this form.

Fifteen cases of spontaneous gangrene of the legs in the puerperium. It may be due to embolism detached from a diseased heart-valve and lodged in the anterior tibial artery, or from arterial thrombosis extending from the placental site to the iliac vessels. The gangrene is usually dry, and the pain very severe, and forms a distinct line of demarkation. Diagnosis is established by severe pain, discoloration, coldness, with loss of sensibility in the part. Wormser (*Centralb. f. Gynäk.*, Jan. 26, 1901).

Among the forms of gangrene affecting the extremities, especially the lower ones, there is one of spontaneous origin, occurring in the comparatively young. In such gangrene, the inner coat of the artery ordinarily, but occasionally of the vein, is found proliferated and thickened, thrombosis follows secondarily, the

organization of the thrombus finally occluding the vessel. To distinguish between the proliferated inner coat and the organized thrombus, is to bear in mind that the former is composed of compact tissue, containing no elastic fibres and occasionally has hæmatin granules deposited within it. The thrombosis extends upward or downward from some point of the proliferated inner coat, or it arises at the very outset in several spots. The arterial sclerosis here does not differ from the ordinary arterial sclerosis. As probable causes of this condition may be mentioned predisposition, certain mechanical and chemical actions, and anything that tends to produce sclerosis. As to age, it is most common between 30 and 50, next between 30 and 40; the left side is more frequently affected than the right; it is also more common in the male than in the female. Kojima (*Sei-T-Kwai Med. Jour.*, July 31, 1903).

ERGOT GANGRENE is also partly of neurotic origin, the main pathological factor being vasomotor spasm brought on by the ingestion of ergot of rye when rye-flour is used instead of wheat-flour in making bread, as is the case in many parts of Europe. The continued consumption of ergot of rye gives rise to various preliminary symptoms: general adynamia, gastric disorders, formication, and fugitive pains. The arrest of the blood-current through the spasmodic contractions of the arteries is soon followed by blanching and lowered nutrition, which makes the part vulnerable to the least traumatism. Even without such, the ill-nourished areas farthest from the centre—the toes, the ears, the nose, etc.—finally succumb.

DIABETIC GANGRENE. — Gangrene is rather frequently observed in diabetics, especially in persons advanced in years. Heidenhain attributes it to the common cause of senile gangrene, arteriosclerosis; the main factor he believes to be an abnormal susceptibility to wound infec-

tion. Still, the fact that internal viscera sometimes become gangrenous in such cases would tend to invalidate this view. In a case witnessed by Turner the pyramids of the left kidneys were found gangrenous. A marked line of separation existed, and every other portion of the organ was healthy, as was also the entire urinary system.

**PRESSURE GANGRENE.**—This occurs when a region in a low state of vitality—such as occurs in prolonged fevers, etc.—is submitted to continued pressure. The vascular supply, already weakened, becomes further weakened, especially when, as is the case over the sacrum, the scapula, etc., the soft tissues are pinched, as it were, between a bone and the bed. The slightest injury over such a site becomes the seat of ulceration, the so-called “bed-sores,” and gangrene is apt to follow, if through the presence of arteriosclerosis and old age the lumen of the vessels is already limited.

Case in which death from septicæmia followed the ritual operation at the hands of the *mohel*. Circumcision was done on the tenth day. Several hours after the operation severe hæmorrhage occurred, which was checked after considerable labor, by the religious operator. Forty-eight hours later the author found the anterior portion of the penis in a condition of dry gangrene, the cause of which was discovered to be a narrow strip of gauze, evidently saturated with some styptic, and tightly constricting the organ. Death occurred on the thirteenth day after the operation. Brothers (Med. Record, Jan. 30, '97).

**SYMMETRICAL GANGRENE**, or Raynaud's disease, is a form which occurs in paroxysms. It begins with paræsthesia and sharp pains. The tips of the fingers and toes, the parts most frequently affected, then become cyanotic and gangrenous. The entire phalanx is occa-

sionally involved. It is occasionally observed in other parts of the body, the unaffected surfaces being usually very pale.

Case of symmetrical gangrene following local asphyxia in the tips of both ears. This localization regarded as rare, from the fact that Raynaud, in his description of the condition which bears his name, makes no mention of such lesions occurring about the face save in one instance in which small cicatrices were seen by him about the nose, though the disease itself had not been observed in this location. In the author's case, anæmia seemed to enter largely into the etiology of the affection, as in Hochen-ezz's, Rham's, and Steiner's cases. Canessa (Revista Medica del Uruguay, Yr. vi, No. 4, 1903).

**CARBOLIC-ACID GANGRENE.**—Carbolic acid has caused gangrene in so many cases that it seems to merit a special place among chemical agents capable of inducing this condition. Even in 2-per-cent. solution, this agent is capable of destroying the life of tissues. The majority of cases reported in which gangrene occurs were felons or slight disorders of the finger-tips or toes. According to Czerny (Münch. med. Woch., Apr. 20, '97), the duration of the application is more important than the strength of the solution, the anæsthetic action of the drug causing it to be left *in situ* prolonged periods at a time. The parts first become grayish white and eventually black. There is no pain, and the gangrene is only revealed by the appearance and the stiffness of the finger or toe affected.

Three cases in which applications of carbolic acid resulted in gangrene. A 2-per-cent. solution of carbolic acid can have a deleterious influence. Leusser (Münch. med. Woch., No. 15, '96).

Eighteen cases of gangrene of the fingers, the result of weak carbolic-acid dressings. This makes a total of 132 cases reported. Carbolic acid in any



strength as a moist dressing is dangerous, and should never be used. F. B. Harrington (Amer. Jour. Med. Sciences, July, 1900).

**Etiology and Pathology.**—The causes of tissue-death are divided by Tillmans ("Surgical Pathology," Rogers's transl.) into four general classes: 1. Interruption of the afferent flow of arterial blood without the development of a collateral circulation, such as may occur in the cases of thrombosis and embolism, or after ligation, or in consequence of the pressure of a tumor or inflammatory exudate. 2. Interruption of the efferent flow of venous blood. 3. Interruption or stasis of the circulation in the capillary walls. 4. Death of the tissue-cells without any disturbance of circulation, due to poison, such as snake-bites, or to micro-organisms or the products of their metabolism, such as are found in infectious diseases of wounds; for example, erysipelas, cellulitis, and septicæmia.

Local and general anæmia, venous stasis, disturbances of circulation from diseases of the vessels,—heart or lungs,—or disturbances of circulation due to inflammation—in short, faulty circulation from any cause—increase the disposition to gangrene from the effects of chemical or thermal influences.

The special etiological factors have been already alluded to, while gangrene as a complication of various infectious diseases has been reviewed in the respective articles upon the latter.

Two cases of gangrene observed following measles in children. In the first case the mouth became sore and later gangrenous. In the second case the right side of the vulva was found covered with a dark, gangrenous spot, the size of a half-dollar, involving the right labia majora and minora, the clitoris, and the vagina in the region of the meatus urinaris. Death occurred in both cases.

G. E. Lochner (Albany Med. Annals, Apr. 4, '96).

Case of a girl, aged 2 years, who, on the tenth day of an attack of measles, presented a *plaque* of gangrene the size of the palm of the hand upon the right lateral aspect of the thorax below the axilla. The periosteum of the subjacent ribs was laid bare, with a part of the great pectoral muscle. Cure resulted without functional impairment after a large abscess had developed in the internal aspect of the arm facing the gangrenous area. The author attributes the localization of gangrene to the habit which the child had of lying on its right side. The compression had produced thrombosis of the long thoracic artery, with consequent gangrene of the tissues, whose power of resistance had been weakened by the disease. Wunder (Münch. med. Woch., No. 20, S. 536, '97).

Case of multiple gangrene of the skin in a nervous, anæmic girl, 21 years of age. After a burn upon the left hand a vesicular eruption attended by severe stinging pain appeared, at first limited to the left arm, but later distributed over the whole body. With the evacuation of the contents of the vesicles upon the left arm discoloration occurred, and an eschar formed which fell off after a considerable time. The defect healed with the formation of scar keloid. Upon other portions of the body the blebs were tensely filled with pure serum or serum and blood, and ruptured after a short time, laying bare the corium; these healed by granulation without the formation of an eschar. After several outbreaks recovery took place, the affection having lasted over a year. The nervous system plays an important rôle in the disease, which depends upon a trophoneurotic process. Hintner (Archiv f. Derm. u. Syph., B. 38, H. 2, '97).

Case of symmetrical gangrene produced by embolism of one iliac artery. Patient died on the twenty-eight day.

In the left common iliac artery was an embolus adherent to the internal coat, which appeared normal. Secondary but non-adherent clots were prolonged downward into the internal and external iliac, the femoral, and the deep femoral arter-

ies. A secondary clot ascended to the bifurcation of the aorta and then descended in the right iliac and femoral arteries. All the secondary clots were soft and non-adherent; those on the right side especially floated in the arteries which they did not fill. The left kidney and the spleen were full of infarcts of the same nature as the iliac embolus. Widal and Nobécourt (*Lancet*, April 16, '98).

Study of 15 specimens of gangrene. In cases due to arterial sclerosis a high-grade sclerotic proliferation of the intima is found, causing stenosis of the lumen of one or more of the main vessels. It threatens the life of the extremity by closing the exit of the branches from the vessel involved, preventing the formation of collateral circulation. A secondary progressive thrombosis is also apt to develop on the changed arterial wall. Senile or diabetic gangrene, a localized petrification of the arteries, sometimes forms. Bunge (*Archiv f. klin. Chir.*, Bd. lxii, H. 1, 1901).

Analysis of personal cases and of all the cases of gangrene following infectious disease found in literature: 166 in all. The most frequent causes were typhoid and typhus fever, and after these influenza, puerperium, and pneumonia, in the order named. Scarlet fever was the cause in only 3 cases, and diphtheria in only 1. The commonest seat is in the legs, 122 cases having gangrene in this situation. There appears to be no difference between the right and left legs, and gangrene of both legs is less common than of either separately. In 128 cases of which the result is known, 42 patients died. The percentage is much higher among women than among men. In 65 cases autopsy showed thrombosis in the main artery of the limb. In many of the others investigation was not made. Eichhorst (*Deutsches Archiv f. klin. Med.*, vol. lxx, H. 5-6, 1901).

Rapidly-spreading gangrene, the *gangrène foudroyante* of French surgeons, is developed when to a necrotic process in the economy there is added a rapidly-

spreading emphysematous condition of the surrounding parts, with increased tension, crepitation, the formation of gaseous bullæ, and a bronzed and streaky discoloration of the skin. The disease, once established, tends to spread rapidly to other parts of the body, and constitutes the most fatal form of gangrenous trouble.

Gaseous gangrene may be produced by various micro-organisms, particularly, however, by the bacillus *aërogenes capsulatus*, which, without having a specific action, behaves in man as a toxin saprophyte upon tissues already seriously damaged. The bacillus *coli communis*, with other germs, may also cause gaseous gangrene. Muscatello (*Rif. Medica*, May 21, 22, 23, 1900).

Case of gaseous gangrene in a non-diabetic person, in which the bacterium *coli* was the sole agent isolated. This germ cannot, however, produce gaseous gangrene alone; its action is then entirely saprophytic and is dependent upon other pathogenic organisms, or upon local or general nutritional disturbances, such as trauma and metabolic diseases. Dansauer (*Münch. med. Wochen.*, Sept. 8, 1903).

Infectious gangrene of the skin is occasionally observed. According to Cail-laud (*Rev. Mens. des Mal. de l'Enfance*, Jan. and Mar., '97), this appears under two conditions: There may be a previous ulcerative skin-lesion, from and upon which the gangrene starts, or the gangrene may appear immediately after a non-ulcerative manifestation of the skin; it is not an occasional accident, but constitutes an essential element of the disease. Any cause which impairs general health predisposes to that contagious affection, and existing ulcerations and erosions serve as a door of entrance for the contagion.

Spreading traumatic gangrene, though usually developed in subjects suffering from general depraved health, occasion-



ally occurs in healthy subjects through infection of the wound by the anaërobic bacillus of malignant œdema of animals, and to which fowls are particularly susceptible. Through the experimental observations of Chauveau and Arloing, Brieger, Ehrlich, and others, the fact has been practically established that the same germ, which, on the one hand, may give rise in animals to malignant œdema, may, on the other, when ingrafted in man on tissue the seat of a moist gangrene, produce the emphysematous condition.

In the field-mouse, an animal immune to the bacillus of septicæmia, Koch has produced, experimentally, a progressive gangrene from inoculations with chain micrococci not to be distinguished from the streptococcus pyogenes. He has also shown that the ptomainic products of bacterial activity may themselves cause the destruction of tissue, since, in the examination of specimens from the inoculated animals, the progressive necrosis was observed markedly in advance of the bacterial invasion.

Case of gaseous gangrene complicating a compound fracture of the right forearm in a boy of 10 years, the bones coming in contact with mud. For the first two days the patient did well, then the arm began to swell and became rapidly emphysematous and gangrenous, with a line of demarkation an inch above the elbow; the swelling was dusky in color and there was crepitation extending over the scapula and below the clavicle. Several long incisions were made along the forearm and gas escaped with great force. Antiseptic measures were carried out and the condition of the arm rapidly improved, probably because of the relief from pressure on the blood-vessels by the gas. Amputation at the junction of the upper and middle third of the arm was necessary, however. The condition is believed to have resulted from infection with the bacillus aërogenes capsulatus, but no bacteriological examination is re-

ported. Reports of 16 cases of infection by this micro-organism in literature, with 12 deaths and 4 recoveries found. C. P. Gildersleeve (Med. Record, Mar. 4, '99).

Study of the nature of the vascular lesions observed in fourteen cases of senile and diabetic gangrene. There is most probably a primary arteriosclerosis obliterans which terminates in thrombosis; the latter extends into the collateral branches, abolishes the anastomotic circulation, and determines the occurrence of gangrene. Bunge (Edinburgh Med. Jour., Sept., 1900).

**Treatment.**—Removal of the causative factors and especially those interfering with free circulation is the first indication. In strangulated hernia—for instance, section of the constricting ring—this aim can be reached; in paraphimosis, pressure from superficial tumors, bed-sores, tight bandages, etc., relief can be afforded in this way. In many cases, however, this resource is not available. In obstruction due to thrombosis and arteriosclerosis, for example, all that can be done is to facilitate the return of the blood by judicious procedures. Elevation of the part, with slight flexion of the extremity affected, gentle massage toward the heart, warmth, taking care to avoid “hot-bottle burns,” which under such circumstances are easily inflicted, represent the minor indications.

When, notwithstanding prophylactic measures, the gangrenous process develops, disinfection of the area should at once begin. Iodoform, orthoform, aristol, and resorcin are valuable in this connection.

Remarkable results obtained in a diabetic who had had gangrene in one leg which necessitated amputation. The other leg became involved, and a succession of scabs formed on the foot. No pulse could be felt in the dorsal artery of the latter or in the posterior tibial. After a half-hour's massage the whole foot and leg were warmer, the tissues

softer, and the tension less, and the dorsal artery could be felt so that the pulse could be counted. The method of work was principally by deep manipulation in a downward direction to aid the arterial current, followed by upward friction, or effleurage, to aid the venous and lymphatic flow. Douglas Graham (Inter. Clinics, vol. iv, series 10, 1901).

The next object is to prevent infection of the healthy tissues beyond by products of decomposition. Any accumulation of offensive fluid or gas should be prevented by evacuating foci and treating the part with antiseptic lotions. An excellent agent in this connection is permanganate of potassium in 1-grain-to-the-ounce solution. Infiltrating abscesses should be followed up to the living tissues above, if needed, to thoroughly clear them of the infecting elements. Carbolic acid should not be used as a disinfectant, since it tends to lower the vital resistance of the tissues.

The adoption of radical measures must be regulated by the progress of the case and the nature of the primary disorder present.

When *amputation* is determined upon, the anatomical distribution of the vascular supply of the part must clearly be borne in mind and an effort made to leave in the flaps, not only unobstructed vessels, if arteriosclerosis or thrombosis be present, but also a sufficient supply to insure proper nutrition. Stephen Smith, of New York (Phila. Med. Jour., Oct. 29, '98), recommends the following amputation when gangrene of the foot is present, and when it is decided to amputate at the knee or through the thigh. There being eight arterial branches in this region, if the incisions and flaps are suitably planned this arterial supply need not be seriously interfered with. His method of amputation is as follows: A straight incision is made from two

inches above the upper border of the patella downward over the centre of that bone to the tuberosity of the tibia. From the lower extremity of this perpendicular incision two curved incisions are made, having their convexity downward, and extending, respectively, in the direction of the external and internal borders of the limb. These two incisions having been united posteriorly by a straight incision across the upper border of the calf, the flaps are dissected up from the tibia and fibula, the patella is removed, and the knee-joint is disarticulated.

It is generally thought advisable not to interfere with the reparative efforts of Nature when the line of demarkation is clearly established. When, however, in the case of an extremity, there is no line and the morbid process ascends here and there or evenly and the patient shows evidences of impending constitutional disturbances, the question of amputation is in order. In arriving at a decision in this connection the various reasons for an amputation should be carefully computed, namely: The nature of the causative disorder; the probabilities as to spontaneous resolution; the subsequent deformity involved, both without and with amputation based upon the parts (muscles, nerves, vessels) already destroyed; and last, but not least, the general health of the patient. These may all prove useful in case of subsequent controversy. Severe injuries followed by gangrene warrant amputation if the tendency to spread is evident. When a putrescent mass, however, though the line of demarkation be present, exposes the patient to general toxæmia, amputation is also warranted as soon as the signs of septicæmia appear. Especially is this true in "traumatic gangrene."



All surgeons agree that a high amputation is to be preferred, and the knee or thigh is usually selected because the profunda femoris is rarely obstructed by thrombi.

In SENILE GANGRENE a conservative line of treatment is indicated, since meddlesome surgery here is liable to be followed by extension of the morbid process. Attention to the healthy tissues of the entire surface is necessary, since a minute abrasion, a slight blow, may become a gangrenous area. As taught by Thomas Jones (*Med. Chronicle*, Jan., '98), when the gangrene is limited to one or two toes and the patient's condition is satisfactory, the surgeon should be content with the expectant plan of treatment, taking precautions to lessen or prevent the effects of local septic infection. When, however, the gangrene has reached the metatarsus, he should be prepared to perform the high operation; that is, amputation above the knee. The local treatment in limited forms of gangrene should consist in thorough cleansing of the foot and leg, free dusting of the immediate vicinity of the dead part with iodoform, and the application over this powder of sublimate or salicylic wool. The use of artificial heat in the form of poultices and fomentations is positively mischievous. Pain may be relieved by the internal administration of opium and the local application of a powder composed of boric acid, sublimate of bismuth, and hydrochlorate of morphine.

Case of synchronous amputation of both thighs for gangrene of the feet under special cocainization. The patient was a man of 68 years. Twenty minims of 2-per-cent. solution of cocaine hydrochlorate were employed, the needle being entered between the fourth and fifth lumbar vertebræ. The result was in every way satisfactory. G. G. Hopkins (*Amer. Medicine*, June 15, 1901).

In the treatment of DIABETIC GANGRENE no special features are indicated. Heidenhain, who has given the subject special attention, states that, as in senile gangrene, as long as the gangrene is confined to one or two toes the line of demarkation should be awaited and the dead tissues allowed to separate of themselves. Removal of the gangrenous portion with forceps and scissors may lead to gangrene of the parts above, although the line of demarkation has been fully established. As soon, however, as the gangrene attacks the sole or the dorsum of the foot, an amputation of the thigh should be made as close above the condyles as possible. Amputation below the knee is nearly always followed by gangrene of the flaps. In 11 cases of diabetic gangrene 6 were saved by thigh amputation. Two of the 3 fatal cases had large quantities of sugar in the urine (8 per cent. and 5 per cent.), while the remaining 2 showed much albumin in addition to sugar. Such cases should avoid even insignificant injuries, which in them may assume serious proportions—precisely as in senile gangrene.

SYMMETRICAL GANGRENE rarely calls for surgical interference. The treatment of the neurosis and constitutional measures are generally sufficient, and has been described elsewhere.

CONSTITUTIONAL MEASURES. — These should not be neglected. Nutrition should receive especial care, and the patient should be supplied with nourishing food. The low diet which older ideas seemed to warrant belongs to the past. Alcoholic stimulants should be given, but in small quantities at a time—just enough to sustain normal cardiac action. Strychnine is a valuable adjuvant, by stimulating vasomotor action. Promiscuous drugging should be avoided.

## Y

**YELLOW FEVER.**

**Symptoms.** — The symptomatology as here given was studied by Dr. Murray, of the Marine-Hospital Service.

The patient may complain of having sickened in the night or early morning, and of headache and malaise, with some gastric distress. A chill sufficiently severe to be spoken of is rare, but chilliness is usually complained of. Distress in the early morning is a rule. Failure to eat a good breakfast is a bad omen, but it suggests a mild case. Fever of  $101^{\circ}$  to  $103^{\circ}$ , with pulse of 110 to 120; cutting pain through the forehead, with aching eyes; fullness of eyes with some pain and suffusion, generally with injection, are probable signs. The back and thighs are painful in a severe case; there is some soreness in the mildest cases. Severer cases will have pain in back of neck and in calves.

By pressing firmly and deeply over the region of the gall-bladder, one will generally elicit a noise resembling a squeak. The face is full and less mobile than in health, with a fullness of the upper lip.

[Passed Assistant Surgeon White reports that he made two diagnoses with the swollen upper lip as the first noticeable symptom.]

The cheeks are more or less dusky, the hue depending also on the patient's color; they are sometimes faintly purplish. Sweating diminishes these facial signs in a few hours. There is congestion of the sclerotics, which increases, until after thirty-six hours, when they tend to become yellowish; in children, the eyes remain pearly. Frequently pressure on the eyeballs will cause pain, especially in bad cases. Primary complete constipation or semiconstipation is always present.

The superficial circulation is abnormal and sluggish; the skin may be streaked by passing the finger over it or paled for a quarter of a minute by pinching; this is a good sign, especially after the disease has progressed thirty-six hours. The skin is moist, as a rule, and stays so to the end, whether drugs are given or not. Yellowness of the skin is not to be looked for early. Unless there is nausea or headache, the patient lies quietly.

There is less rapidity of pulse than the febrile condition present warrants, judging from lung disorders and enteric fever. An inveterate smoker's pulse may become reduced when the amount of tobacco used is also reduced. After  $2\frac{1}{2}$  or 3 days the pulse falls below 70 and later on lower yet; fright and irritation cause the slowness to pass unobserved. The pulse should be counted without the patient's knowledge.

The above signs are sufficient to warrant isolation, even if there is no known case of the fever within a thousand miles.

After sixty hours there should be some albumin in the urine, but it may be absent. Anuria may exist, but in women is not reliable, while in children it is sometimes difficult to obtain. Albumin should not be confounded with mucin. Other symptoms should not be treated lightly because no albumin is found in the urine.

At this stage some brown mucus, or black discharges, or "bismuth" stools may be looked for: early in mild cases—late sometimes in severe ones. This is only confirmatory evidence, however. Mild cases suffer from distaste for usual food only, and, of course, there is anorexia from the beginning. The vomit-



ing of the last food taken is usual, and bile is voided early if the early nausea is not checked, but no bile will be vomited during the thirty-six hours following proper bowel movements.

After vomiting the last food taken and a little bile, the vomit usually becomes white, and remains so until blood oozes into the duodenum or stomach: the source of the black vomiting. Hiccough and retching appear, and the black fluid may be heard regurgitating through the pylorus into the stomach.

[The gravest two symptoms that can arise during the course of a case of yellow fever are undoubtedly black vomit and suppression of urine. Black vomit is caused by rupture of walls of capillaries or venous and arterial radicles, and the discharge of blood into the cavity of the stomach, where, coming into contact with hyperacid gastric juice, it becomes altered into small masses of brownish-black color, somewhat resembling coffee-grounds in gross appearance. Its advent may also indicate a general hæmorrhagic diathesis, which may be manifested by hæmorrhages from the nose, gums, fauces, rectum, or by extravasations into the connective tissue of the scrotum. The abrupt appearance of black vomit in large quantities without warning is unusual. Careful search will often show minute brown or black particles floating in clear fluid, and presenting the appearance described by some authors as "bee's or butterfly wings." It is not uncommon, however, that patients just before death should vomit a large quantity of black vomit, and that after death the stomach should be found to contain several quarts of the fluid. It would seem probable that in these cases the hæmorrhage which produces it was more of an active hæmorrhage than a capillary oozing, and that death comes quickly as the result of shock. H. D. GEDDINGS, U. S. M. H. S.]

**FULMINANT CASES.** — Sometimes the symptoms appear in such quick succession that we think the attack is neces-

sarily fatal. Often in such cases we have no chance to ask the patient how matters fared with him twenty-four or thirty-six hours before. Walking cases are as common in this as in the other bed diseases. The case of a man may be reported who suffered from headache for three days while on duty, black vomit occurring while he was on the stairs on the way to his death-bed.

**Diagnosis.** — The diagnosis of yellow fever as here presented was obtained from a report by Dr. John Guitéras, formerly of the U. S. Marine-Hospital Service.

The diagnosis of individual cases of yellow fever is very easy. There is no acute febrile disease in which there are as many signs that may be called pathognomonic. The diagnosis of the disease rests upon three such symptoms, namely: the facies, the albuminuria, and the want of correlation between the pulse and temperature. The facies is extremely characteristic, but it is well not to announce officially the existence of yellow fever until the presence of albumin in the urine is shown.

**FACE.** — The appearance of the face is that of typhus fever during the first forty-eight hours of this disease or like that of measles before the eruption breaks out, with a more or less pronounced icteroid hue. It is the latter feature which gives the face its characteristic appearance. In the first twenty-four or forty-eight hours it is by no means a distinct jaundice. It is, of course, best noted in the sclerotics, but is hidden by the marked injection of the smaller vessels. The icteroid hue is often better seen at some distance from the patient than when the eye is closely inspected. It seems to show itself in waves with the different movements of the eye. Possibly this is the result of

transient contraction of the vessels of the conjunctiva or of the different angles of reflection of the light upon the eyeball. In severe cases, and on the second and third day of the disease, the jaundice becomes more prominent. It will show itself in distinct waves as the capillaries of the skin contract with the movements of the facial muscles or it may be brought out by taking up a fold of the skin between the fingers, when the contrast between the yellowish, anæmic skin and the surrounding congested areas will become well marked. Later on there may be well-marked jaundice. By this time usually the florid color of the face has been replaced by a more dusky hue. In the later stages of the disease there are also characteristic features of the facies in grave cases. The mind is usually clear, and there is a peculiar alertness and watchfulness that is not seen in other acute febrile diseases.

**ALBUMIN.** — The albumin appears in the urine usually on the third or fourth day of the disease. It may be very transient albuminuria. In many mild cases the albumin is present only in the urine passed in the evening of the third or fourth day. In many cases it is only a trace, but even then by a careful centrifugation granular casts may be found. In severe cases the quantity of albumin may be very great and the different forms of casts characteristic of acute parenchymatous nephritis are found in abundance. Now, there are many acute febrile diseases in which albumin may be found in the urine, but in none of them so constantly nor so early when in connection with such mild manifestation of the toxæmia. In all such diseases the albuminuria will be found at the end of the first week or during the second week, and as an evidence of persistent high

temperature and intense toxæmia. Cases of yellow fever corresponding in intensity with these present, at the same time, such characteristic features that it is impossible to mistake them. The difficulty of diagnosis can only be met with in connection with mild cases.

**PULSE AND TEMPERATURE.** — The third characteristic symptom of yellow fever is the want of correlation between the pulse and the temperature. This may be a rather late manifestation and may be absent, especially in children. It should be remembered that the characteristic feature of yellow fever in this connection is not a slow pulse during the convalescence or even during the defervescence of the fever. The characteristic feature is that quite often we find that at the same time that the temperature may be rising the pulse will be falling. On the third or the fourth day of the disease, for instance, with an evening exacerbation of half a degree or one degree of temperature, we may find that the pulse is, perhaps, ten beats slower than in the morning. The same discrepancy may appear, however, in cases of true dengue, and in the tropics also, in connection with other febrile diseases. Still, this is exceptional. In dengue the excessive fall of the pulse presents itself with a distinct defervescence of the temperature, and it is probable that many cases that are reported from Cuba of slow pulse in typhoid and malarial fevers may have been cases of yellow fever.

**MICROSCOPICAL EXAMINATION.** — Poorly prepared abstracts from the work of Sanarelli have led many to believe that a characteristic feature—the bacillus of Sanarelli itself—was found on examination of the blood. Even with the assistance of post-mortem examinations, Sanarelli was able to discover his bacil-



lus in 56 per cent. only of the cases of yellow fever. He would be a poor clinician, indeed, who could only diagnose about one-half of the cases. Indeed, during life the microscope cannot establish a positive diagnosis. As far as our present methods go, it would be impossible to distinguish between a drop of yellow-fever blood and blood from a healthy man.

Negative evidence may be presented by the microscope. The presence of the *Plasmodium malariae*, for instance, would prove that a case was suffering with malarial poisoning, and presumably not with yellow fever. But the differential diagnosis between these two diseases is usually easy. The bilious remittent fever, that in our old text-books of medicine occupied a conspicuous place in tables of differential diagnosis with yellow fever, has practically disappeared from the Southern sea-border since yellow fever ceased to be an endemic there. It was, in fact, the yellow fever of the natives and of places in the interior. The former were supposed to possess some immunity against yellow fever, and the disease was believed to be restricted almost to the littoral.

The plasmodium has been found in the blood in cases of yellow fever. The mistake made by the board of experts of New Orleans, when they failed to recognize the existence of yellow fever at Ocean Springs, was due to the finding of the plasmodium in at least two of the cases.

**DENGUE.**—The prevalence of a widespread, mild, epidemic of fever during a recent outbreak of yellow fever has been undoubtedly a source of doubts and difficulties in connection with the diagnosis.

Many of these cases were found to exist in houses where cases of yellow

fever were present at the time, and it was impossible to discover in them any of the characteristic symptoms of yellow fever. Many of these cases had a distinct eruption and must be looked upon as cases of dengue. This fact may bring forward new problems as to the relations between these two diseases. From our present point of view, we can only state that yellow fever appears to spread more easily when there is an epidemic of dengue prevailing. All evidence goes to show that a previous attack of dengue does not protect against yellow fever, and we must look upon the former as an entirely distinct disease.

Differentially considered, dengue has a demonstrable rash in the fauces always; between the shoulder-blades, generally; and often over the great joints and on the trunk. The pains of dengue are in the bones and joints. A dengue patient suffers and cannot lie still—he does not want to get up. In yellow fever the pains, except the head, are in the muscles, and the patient after four or five days is comfortable in bed, but wants to get up and work.

Malaria is usually prodromed for some days by malaise, loss of appetite, discontent, and a general feeling of fatigue. It nearly always attacks in the day-time or when the victim is at his work, and is ushered in with a positive chill. Constipation is the rule, but not so marked a feature as in yellow fever. The malarial tongue is swelled, tooth-marked, and heavy-coated, with white edge and yellow or dirty top-area. A yellow-fever tongue is rarely indented; the tongue of the former soon shrinks and has a red edge and red tip, the red tip being diamond shaped. Herpes does not occur in yellow-fever cases; it is common in malaria. This is, however, a late sign. R. D. Murray ("Yellow Fever: its Nature, Diagnosis, Treatment, and Prophylaxis," etc., by Officers of the U. S. Marine-Hosp. Service, '98).

**Etiology and Pathology.**—The natural habitat of yellow fever may be said to

be the western coast of Africa, the West Indies, Central and South America so far south as the fortieth degree of latitude. It does not prevail in Japan, China, or India, or anywhere in Europe, nor does it naturally prevail anywhere on the mainland of the Northern Continent of the Western Hemisphere. Yet it may be carried almost anywhere, and imported epidemics have occurred at ports of England and Spain, and nearly all the northern ports of the Atlantic sea-board of the United States, including New York, Boston, and Portsmouth, N. H. Formerly it frequently attacked the northern ports of the United States on the Atlantic, but, as I believe, by reason of improved sewerage, paving, water-supply, and general sanitary conditions, it has ceased to be a specially dangerous menace north of the southern boundary of Maryland. Although it may prevail inland, it is pre-eminently a disease of filthy sea-ports, and is carried from one port to another by ships.

By some its importation into the West Indies is asserted to have been caused by, as it certainly was intimately associated with, the negro slave-trade from Africa; but other historians believe it was found here by Columbus when he discovered America. The French writer Béranger Féraud insists on its American origin, and declares there was an epidemic of it in Haïti as early as 1493, after the battle of Mesa Real between the Spaniards and Indians.

The principal yellow-fever ports are Rio Janeiro, Santos, Bahia, and Pernambuco, in Brazil; Vera Cruz, Tampico, Maracaibo, Colon, and Panama. These ports are worse at some periods than at others, but it constantly prevails in one or more of them, and when one port becomes free from the disease it is subject to infection again from one

of the other ports. There was no known yellow fever in Rio Janeiro until 1848, when it was introduced by an American ship from New Orleans, which, however, had stopped *en route* at Pernambuco, Brazil.

These facts will illustrate the necessity for an international agreement for the elimination of yellow fever, which will be referred to hereafter.

Of all ports, Havana was for a long time the most dangerous to the United States, both because of its propinquity and because, under the criminal negligence of the Spanish rule, all sanitation was disregarded. During the American occupancy, however, subsequent to the Spanish-American War, Havana was freed from this disease by active sanitary and quarantine measures, and no case of yellow fever is known to have originated in Havana since 1901.

Yellow fever, then, is a disease of the Western Hemisphere. For a long time, principally in New Orleans, where it formerly prevailed so frequently, it was a matter of animated discussion whether it was not there indigenous, but the establishment of the Holt system of scientific quarantine and the experience of the United States Army in New Orleans under General Butler have proved almost beyond question that it is not indigenous. Yet, while it is not a natural inhabitant of the United States, there have been few years in the history of our country when it has not been brought to our shores. Once introduced and neglected, it will spread, particularly along the sea-coast of our southern territory, and the records show that during the nineteenth century there were but nine years in which yellow fever did not visit the United States. In other words, in each of 91 years in the nineteenth century our



shores have been visited. Some terrible epidemics have occurred in these years, notably in 1878 throughout the whole South, when the estimated deaths were 16,000; New York, 1803, 700 deaths; Boston, in 1802; Philadelphia, 1798, 3500 deaths, and 1805, 300 deaths; Nantucket, 1763; Charleston, 1858, 717 deaths; Norfolk, 1853, 1600 deaths, and 1855, 1807 deaths; Savannah, 1876; New Orleans, 1853, 7970 deaths, 1867, 3093 deaths; Galveston, 1867, 1150 deaths.

As to the nature of yellow fever and without reference to its ultimate cause, it was long recognized as a disease of the tropics, requiring heat and moisture for its development. When epidemic it was observed to spread frequently quite as rapidly in the clean portions of a city as in the filthy. The demonstration of mosquito conveyances is a satisfactory explanation.

The conveyance of yellow fever by clothing or other fomites has been the subject of much discussion since the proven conveyance of the disease by mosquitoes. The United States Quarantine Regulations of 1903 are based on the mosquito transmission alone. The *status* of this somewhat vexed question is well expressed in the following quotation from an address delivered before the American Medical Association in New Orleans, May, 1903, by the eminent physician and sanitarian, Stanford E. Chaillé. Dr. Chaillé says:—

“The probabilities now are that the *Stegomyia*, the only cause yet proven, is the sole cause for the dissemination of yellow fever; but that time is required to convert these probabilities into certainty. Boards of health, should they neglect any practicable measure of warfare against the *Stegomyia*, would deserve the severest punishment of the

worst criminals. . . . Boards of health are representatives of the people and are justified in continuing to disinfect fomites as long as public opinion may favor this measure and until the probability of its inutility is converted into certainty.

“To my many friends who urge that Mrs. *Stegomyia* has inherited all the claims of her father, Mr. Fomites, who is dead and ought to be buried, I tender the advice given at a numerously attended funeral by the undertaker: ‘Gentlemen, gentlemen, please don’t crowd the mourners’—mourners over the remains of Mr. Fomites!”

Since 1878, which was the year of the last great epidemic of yellow fever in the United States, although it has been repeatedly caught in the coast quarantine sieve, there have been but five years when it has prevailed to any considerable extent anywhere in the United States. It prevailed in Florida, particularly in Jacksonville, in 1888. In 1893 it was admitted, before the present Quarantine Regulations made under the law which was passed by Congress in 1893 had been put into effect, into Brunswick, Georgia; but, owing to the efforts of the Marine-Hospital Service, it was confined to that city and one or two neighboring localities, and there was no interruption of traffic. The number of cases was 1076 and the number of deaths 46. In 1897 the disease was introduced into Ocean Springs, Mississippi, as early as April by a traveler who came from San José on the Pacific Coast of Guatemala, took passage from Port Barrios on the Atlantic Coast of Guatemala, came through New Orleans on April 12th, and arrived in Ocean Springs on April 13th, sick. The disease was not recognized until September 4th, when it was declared to be yellow

fever. From this summer resort the people had been coming and going through all the intervening months, and on the announcement of yellow fever they scattered in all directions. It was on this account the disease was so widespread, involving a number of places in Louisiana, Mississippi, Alabama, a few cases being also discovered in Texas. There was, in all, a total of 4429 cases and 484 deaths reported.

The fever in the summer and fall of 1898 undoubtedly was a recrudescence from the previous year. The winter had been an exceptionally mild one—so mild as to permit the germs to lie dormant. There were reported, in 1898, 2456 cases and 115 deaths. In the summer and fall of 1899 the disease again appeared in Louisiana and Mississippi, and, notwithstanding the previous severe winter, it is thought to have been a recrudescence.

In each of these years—1893, 1897, 1898, and 1899—the type of the disease was surprisingly mild; so mild, in fact, that at the beginning of each outbreak, excepting that of 1899 in New Orleans, the disease was not recognized, being confounded with malaria and dengue.

In 1898, during the Spanish war, there were cases of suspicious fever occurring in Key West, Fla., but a searching inquiry led to the opinion by experts that the disease was dengue, and, while the spread of the malady was considerable, there were no fatalities.

In 1899 yellow fever made an actual appearance in Key West. Its origin is wrapped in some mystery; by some it was thought to have been a recrudescence from the 1898 cases referred to above, but this was never proved, and involves the admission that the cases in 1898 were yellow fever and were not recognized as such. If the disease was imported the method and channel of its

importation has never been satisfactorily demonstrated. It is, however, well known that many years had elapsed since the prevalence of yellow fever in epidemic form in the city, and during these years the children born and strangers present in the city in large numbers formed a larger non-immune population than had resided there in many decades previously. From Key West the fever spread to Miami, and 10 cases appeared also in Port Tampa, there being in Florida a total of 1536 cases and 84 deaths reported. A probable recrudescence of the disease in New Orleans, La., in the same year gave 115 reported cases and 20 deaths, and various small outbreaks in Mississippi gave 90 cases and 11 deaths.

The mortality from yellow fever in the United States during one hundred and two years,—1798-1899, inclusive—obtained from the incomplete statistics which have been recorded, is 80,935. This shows that the average annual mortality from this disease is 793. There have been several severe epidemics of yellow fever in the United States, and the disease has prevailed extensively in smaller towns and in the country at different times, in which the mortality from the disease has not been recorded. Hence, the average annual mortality from this disease is much greater than the above figures show.

#### Influence of rain-fall on yellow fever:

(1) a dry state of soil furnishes conditions that are favorable as antecedents of yellow fever; (2) when this dryness is terminated by rain, the explosion occurs and continues with a moderate amount of moisture; (3) soil-wetness in well-pronounced fevers causes the decline of fever; (4) habitual wetness or moisture of the soil is unfavorable to yellow fever. C. H. Eyles (Edinburgh Med. Jour., Dec., '98).



All places within a yellow-fever-infected district, or town even, are not infected or are infected in unequal degrees. The infection is especially confined to the habitations of men and their environment, and is conveyed a short distance, possibly two hundred and twenty metres down the wind, from an infected focus. Two hundred and twenty metres is the maximum distance this infection can be conveyed. The infection is heavy and hangs and spreads near the ground. It is unable to pass a close wall of any considerable height, although under the shady side of such a wall it may spread well when once started. It seems especially active at night, and certainly, out of doors, is less apt to be contracted on clear, dry days.

The rate of propagation of out-door infection is increased in cities in dusty weather. Strong, steady winds in clear weather lessen the infection. There is no reason to believe that yellow fever as usually propagated in this country is water-borne—the fresh-water tanks of infected vessels have never been and are not now emptied at our maritime quarantines. H. R. Carter ("Yellow Fever: its Nature, Diagnosis, Treatment, and Prophylaxis," etc., by officers of the U. S. Marine-Hosp. Service, '98).

For the belief that yellow fever is conveyed in nature *only* by a host, and doubtless a mosquito host, Surgeon H. R. Carter summarizes as follows: 1. The analogy of other diseases conveyed by insect hosts. 2. That all facts observed about the propagation of yellow fever agree with the necessary deductions of this theory. 3. No other theory explains all the facts observed of its propagation. The second postulate, may be, I think should be, tested further by the collection of other facts to be compared with the theory; possibly on the lines given above, for obtaining direct negative evidence about this theory of conveyance. Yet the evidence already extant seems to the writer convincing, and he is convinced that yellow fever is conveyed in nature *only* by a mosquito host of a particular kind or kinds. H. R. Carter ("Methods of the Conveyance of Yellow-Fever Infection," Yellow Fever

Institute Bulletin, No. 10, July, 1902—Revised Edition).

*Yellow-Fever Institute of the United States Public Health and Marine-Hospital Service.*—In view of the importance of the definite determination of the cause, means of spread, history and statistics, and quarantine management and therapeutic treatment of yellow fever, it was determined to form within the U. S. Marine-Hospital Service an institute for the investigation of these problems. This institute was founded about two years ago for the purpose above indicated, and to bring to this work the aid of all reputable physicians who might desire to take part therein, its membership including, besides the officers of the Marine-Hospital Service, special investigators both in this and foreign countries. It is divided into four sections, the chairman of each section being one of the division officers of the Bureau to which, under Bureau organization, matter of a kindred nature would naturally come. These, together with the chairman and secretary of the institute, form an executive board to consider, especially with regard to publication, the contributions received from the members. Twelve bulletins have been issued. A thirteenth, and the most important of all, relating to the cause of the disease, is now printed and ready for distribution. This bulletin contains the report of a working party sent to Vera Cruz last summer to investigate and attempt to find the causative agent of the disease. Their work was continued during the winter with the material obtained in Vera Cruz, and gives evidence that progress has been made toward a final result. A second working party of three, two of whom were in the first party, are now in Vera Cruz and vicinity

pursuing a continued investigation, and it is the purpose of the institute to continue in the prosecution of this work until successful. This institute embraces new features in the investigation of the cause of a specific disease, and if the result is successful with regard to yellow fever it may be that the new features of organized effort which it embraces will be applied to the investigation of other diseases.

The conclusions of the Vera Cruz working party (1902) published under date of February 17, 1903, in Yellow-Fever Institute Bulletin No. 13 (Treasury Department, Public Health and Marine-Hospital Service), are as follows:—

1. That the bacteriological examination of the blood of cases of yellow fever during life and the blood and organs at autopsy performed immediately after death in uncomplicated cases is negative.

2. That *Stegomyia fasciata*, when contaminated by feeding on a case of yellow fever forty-one and a half hours after the onset of the disease and subsequently fed on sugar and water for twenty-two days, one and a half hours, can, when permitted to feed on a non-immune individual, produce a severe attack of the disease.

3. That *Stegomyia fasciata*, contaminated by feeding on a case of yellow fever and after varying periods killed, sectioned, and appropriately stained, presents with regularity a protozoan parasite, the *Myxococcidium stegomyia*, that can be traced through a cycle of development from the gamete to the sporozoite.

4. That *Stegomyia fasciata* fed on blood from a case of malarial fever, on normal blood, or artificially fed does not harbor the parasite indicated in conclusion 3.

The following are the resolutions adopted by the First General International Sanitary Convention of the American Republics, held at Washington, D. C., December 2, 3, and 4, 1902:—

- (a) *Resolved*, That measures of prophylaxis against yellow fever shall be based upon the fact that up to the present time the bite of certain mosquitoes is the only proven natural means of propagation of yellow fever.

- (b) *Resolved*, That the governments represented in this conference approve the measures employed in Havana for the prevention of the spread of the disease *on land*, for the isolation of cases and the fumigation of buildings, it being understood that said measures are based upon the principle enunciated in Resolution a.

- (c) *Resolved*, That the prevention of the importation of the disease by vessels, wherein persons actually infected are found, must conform to the methods employed on land; yet there are questions concerning the importation of infected mosquitoes that require further study before any decided modification of the quarantine laws can be recommended.

- (d) *Resolved*, That the subject of bringing the quarantine laws to conform with the new doctrine of mosquito infection shall be referred to the International Sanitary Bureau of the American Republics, for report at the next meeting.

There does not exist any lesion truly pathognomonic of yellow fever. The cadavers of the victims of yellow fever are either sterile or they are found to be invaded throughout by a mixture of microbes. The specific microbe, to which the name of "*bacillus icteroides*" has been given, has never been found alone in the autopsies made. It must be sought for in the blood and in the tissues, and not in the gastro-intestinal



tube, in which it has never been encountered. Upon the result of investigations it may be said the isolation of the specific microbe of yellow fever is possible in only 58 per cent. of the cases. This bacillus is a little rod, with rounded extremities, united at best by pairs in cultures and in groups in the tissues, from two to four micromillimetres in length, and generally two or three times longer than it is broad. The microbe of yellow fever is pathogenic for the greater number of the domestic animals. The diffusion of the virus of yellow fever can take place as well by air as by water. Sanarelli (Medical Record, July 24, '97).

It is evident from observations that the micro-organism described by Sanarelli is identical with the bacillus X which has been personally described. Cultures containing the bacillus X produce vomiting, fatty degeneration, and hæmorrhagic enteritis, proving that its action is identical with that of Sanarelli. Sternberg (Med. and Surg. Reporter, Nov. 6, '97).

The following conclusions are based upon the study of 348 specimens of urine, 154 of blood, and 51 autopsies:

1. Albuminuria and presence of bile in the urine is a constant symptom in yellow fever, appearing about the fourth day in mild and earlier in severe cases.
2. The presence of the malarial hæmatozoön does not preclude the possibility of yellow fever.
3. In solutions one to ten the yellow-fever blood does not give any reaction with pure cultures of the typhus bacillus.
4. If we except the diminution of hæmoglobin, the blood does not show any marked changes.
5. The most characteristic pathological changes in the organs are the marked steatosis and congestion of liver, kidney, and heart; the marked congestions, erosions, and hæmorrhages of the stomach and intestines; and, usually, absence of lesions in the spleen and lungs. The other tissues present a marked icterus and congestion.
6. The bacillus which we isolated and with which we have experimented is identical with that reported by Sanarelli as the bacillus icteroides, and the results obtained would justify us in considering it the special cause of

yellow fever. O. L. Pothier (Jour. Amer. Med. Assoc., April 16, '98).

The findings of yellow fever post-mortem are as follows: The skin and sclerotics markedly icteric; usually early ecchymotic spots on the back of the neck, shoulders, and lumbar regions, thighs, calves of legs, and the ears. The abdomen is usually dry, sometimes a little fluid is present; the liver is contracted away from the ribs, of a box-wood color, bloodless, and friable. The gall-bladder is contracted, usually empty, but sometimes containing a thick, tarry fluid. The spleen is normal in size and color. The kidneys are normal, sometimes showing signs of recent acute inflammation. The stomach is usually anæmic, generally shows exfoliated spots where hæmorrhages have occurred, and frequently contains black vomit. The intestines generally contain a pasty-colored material like the stools, only not so black. The mucous membrane of the whole alimentary tract shows the most decided effects of the poison. The heart often shows traces of fatty degeneration. Report of Cuban Commission of Mississippi (Jour. Mississippi State Med. Assoc., May, '98).

Characteristic features of the autopsy-findings in cases of yellow fever are rigidity of the body, yellowness of the skin, extensive hypostatic congestion, dilated pupils, and bloody gums. Internally there is yellowness and dryness of the peritoneum, congestion of the omentum, congestion and swelling of the kidneys, and extravasation in the mucous membranes. The liver and spleen are usually normal in size. The former may vary in color from buff to dark brown, and may present a nutmeg appearance. There is usually extensive fatty degeneration. There are ecchymoses in the pericardium, but the thorax is not otherwise characteristic. E. Wasdin (Medical News, Sept. 3, '98).

The bacillus icteroides has been found and isolated in pure culture, either before or after death, in yellow fever only, and it has been found in all localities in which this disease is prevalent. The isolation of this micro-organism is possible in practically all cases. The

*bacillus icteroides* reproduces all the symptoms and all the anatomical lesions in animals that are considered the most clearly characteristic of yellow fever in man. The injection of the chemical products elaborated *in vitro* by the *bacillus icteroides* reproduces in animals and in man all the typical symptoms of yellow fever. Out of 90 cases in which the blood of healthy individuals or of those suffering from other diseases than yellow fever and who have never had yellow fever had been examined by the method of serum-diagnosis, there were only 3 positive results. But the patients who presented these positive results had probably had "black vomit" at a previous time. In a series of 20 observations on the blood of patients who had recovered from yellow fever for periods varying between several weeks and twenty years, 18 were positive. Patients who had been cured of yellow fever longer than twenty years did not present the reaction. Sanarelli (Sem. Médicale, April 4, 1900).

Sanarelli's *bacillus icteroides* is no more concerned in the production of yellow fever than are the common colon bacilli which are frequently found in the blood and viscera of individuals suffering, or dead, from that disease. Those who report that they have found the *bacillus* in all cases, and that they can make the diagnosis by the agglutinating action of the blood, are the victims of errors. Charles Smart (Phila. Med. Jour., Oct. 20, 1900).

The blood taken during life from the general venous circulation, on various days of the disease, in eighteen cases of yellow fever, successively studied, has given negative results as regards the presence of *bacillus icteroides*. Cultures taken from the blood and organs of eleven yellow-fever cadavers have also proved negative as regards the presence of this *bacillus*. *Bacillus icteroides* (Sanarelli) stands in no causative relation to yellow fever, but when present should be considered as a secondary invader in this disease. From the second part of their study they conclude that the mosquito serves as the intermediate host for the parasite of yellow fever,

and it is highly probable that the disease is only propagated through the bite of this insect. W. Reed, J. Carroll, A. Agramonte, and J. W. Lazear (Phila. Med. Jour., Oct. 27, 1900).

Laborious clinical observation has culminated in the formulation of a group of infectious diseases called the "acute infectious diseases." They have characteristics in common: primarily, they are infectious; they are characterized by clinical symptoms due to the influence of intoxicants; they are all specific infections; many of them are caused by vegetable micro-organisms of low type. Clinically, these diseases closely resemble each other until the development of their specific symptoms, after which they are readily diagnosticated. Pathologically the chief disasters arise from the influence exercised by the toxins formed by the organisms. In some of these diseases the infecting organisms also pass into the circulation and add their effect to that of the toxins. Coinstantaneously there are developed two inherent forces, or qualities, in the infecting germ: toxicity and septicity. The germs, intensely toxic, produce a reaction resulting in the fatty degenerations and, at times, the necroses in the parenchyma of the organs. Those intensely septic are characterized by more prolonged clinical symptoms, less marked fatty changes, and more marked necroses in the tissues. Each infecting organism is specific, and it is only so when it has entered into contact with the living tissues, when, if the environment is propitious, this potential becomes a developed force. When these developments are mixed, the pathological changes are found to be combined. When the toxic potential is strongly developed there will arise the acutely toxic cases; if it is only slightly developed, such cases will be ephemeral; if the septic potential is developed, either alone or in conjunction with the toxic, there must arise the septic cases of these diseases. The three types of cases named are and have been recognized thus far only in yellow fever (Sternberg), although they may all now be recognized in the other acute infections. The



writer continues that it is in the application of this law to the acute infection of yellow fever, explaining its symptomatology and its pathology upon these firm facts, that he now contends that yellow fever cannot be rudely torn from its place in the list of acute infections and placed, as Reed and Carroll would have it, among the accidental, artificial inoculations, which appears to be the fate of the malarial fevers at this time. Each one of the specific infectious organisms may be able, under artificial inoculation, to produce its specific disease, but this does not remove these diseases from the list of natural infections. Eugene Wasdin (*Medical Record*, from *Phila. Med. Jour.*, Nov. 17, 1900).

Report on yellow fever by the Yellow Fever Commission of the Liverpool School of Tropical Medicine:—

1. Sufficient search reveals the presence of a fine, small bacillus in the organs of all fatal cases of yellow fever. We have found it in each of fourteen cadavers examined for the purpose. In diameter the bacillus somewhat recalls that of the influenza bacillus; as seen in the tissues, it is about four microns in length.

2. This bacillus has been found in the kidney, the spleen, in mesenteric, portal, and axillary lymphatic glands taken from yellow-fever cadavers directly after death. In the contents of the lower intestine apparently the same bacillus is found often in extraordinary preponderance over other micro-organisms. Preparations of the pieces of "mucus," which are usually, if not always, present in yellow-fever stools, at times may present almost the appearance of "pure culture."

3. Preparations of the organs usually fail to show the presence of any other bacteria, whose absence is confirmed by the usual sterility of cultivation experiments.

4. It is probable that this same bacillus has been met with, but not recognized, by three other observers. Dr. Sternberg ("Report on Etiology and Prevention of Yellow Fever," 1890) has mentioned it, and he has also recorded the finding of similar organisms in ma-

terial derived from Drs. Domingos Feire and Carmona y Valle, but he did not recognize its presence frequently, probably on account of the employment of insufficiently stringent staining technique.

5. It is probable that recognition has not been previously accorded to this bacillus by reason of the difficulty with which it takes up stains (especially methylene-blue), and by reason of the difficulty of establishing growths on artificial media.

6. The most successful staining reagent is carbolic-fuchsin solution (Ziehl), diluted with 5-per-cent. phenol solution (to prevent accidental contamination during the long staining period); immersion for several hours, followed by differentiation in weak acetic acid. Two-hours staining period may fail to reveal bacilli, which appear after twelve to eighteen hours. The bacilli in the stools are often of greater length than those in the tissues, and they may stain rather more easily; naturally the same is true of cultures. Some of our specimens have already faded.

7. Since the bacilli are small and comparatively few in numbers, they are difficult to find. To facilitate matters at our last two autopsies (fourteenth and fifteenth), a method of sedimentation has been adopted. A considerable quantity of orange-juice is emulsified with antiseptic solutions, minute precautions against contamination and for control being taken; the emulsion is shaken from time to time and allowed to settle. The method is successful and may form a ready means of preserving bacteria-containing material for future study. The best fluid for the purpose has yet to be worked out; hitherto normal saline with about  $\frac{1}{5}$  per cent. sublimate has been employed.

8. Pure growths of these bacilli are not obtained in ordinary aërobic and anaërobic culture-tubes.

9. Some pure cultures have been obtained by placing whole mesenteric glands (cut out by means of the thermocautery) into broth under strict hydrogen atmosphere. Investigation into the necessary constitution of cul-

ture-media for successful cultivation is in progress.

10. Much search was made for parasites of the nature of *protozoa*. We conclude that yellow fever is not due to this class of parasite. Our examinations were made on very fresh organ juices, blood, etc., taken at various stages of the disease, with and without centrifugalization, and on specimens fixed and stained in appropriate ways. We may add that we have sometimes examined the organs in the fresh state under the microscope within half an hour after death.

11. The endeavor to prove a man-to-man transference of yellow fever by means of a particular kind of gnat by the recent American Commission is hardly intelligible for a bacillary disease. Moreover, it does not seem to be borne out by their experiments nor does it appear to satisfy certain endemiological conditions. It is proposed to deal more fully with the endemiology and epidemiology of the disease on a later occasion.

12. We think that the evidence in favor of the etiological importance of the fine small bacillus is stronger than any that has yet been adduced for any other pretended "yellow-fever germ." At the same time there is much further work to be done ere its final establishment can be claimed. The acquisition of a new bacterial intestinal inhabitant would explain the immunity of the "acclimatized." H. E. Durham and Walter Myers (Johns Hopkins Hosp. Bull., Feb., 1901).

Löffler and Frösch showed that the micro-organism of foot-and-mouth disease of cattle passes readily through a porcelain filter. Hence the specific agents of some of the acute and infectious diseases of man and animals might also belong to this group of ultra-microscopical organisms. Observations conducted along the same lines as those above mentioned undertaken to throw additional light upon the etiology of yellow fever. Six individuals, supposedly non-immunes, were bitten by mosquitoes, and of this series four gave negative and two a positive result. The

blood from the positive cases was used for the purpose of inoculation. The three kinds of material derived from the blood of a positive were as follows: (a) the unheated and partially defibrinated blood; (b) the partially defibrinated blood, which had been heated to a temperature of 55° C. for ten minutes; and (c) the diluted blood-serum, which had been filtered through a Berkefeld filter. Each of these materials was used for the inoculation of one or more non-immune individuals. A patient treated with *a* developed a typical case of yellow fever, and this demonstrated that the blood drawn from the general circulation of a case at the beginning of the third day contained the specific agents of the disease. Three cases injected with *b* gave negative results, and, of three non-immune individuals who received subcutaneously an injection of *c*, two developed an unmistakable attack of yellow fever. The third case was negative. As a further test and in order to determine whether the serum filtrate contains something more particulate than a soluble toxin, the writer inoculated a third individual with blood drawn from one of the patients whose attack had been occasioned by the injection of 1.5 cubic centimetres of serum filtrate. If under these circumstances it would be found that the injection of a small quantity of blood was followed by an attack of yellow fever in the third individual, the evidence would point clearly to the presence of the specific agent of the disease in this blood, for it is difficult to believe that a toxin which had undergone so great a dilution in the body of the second individual would still be capable of producing the disease. The patient so inoculated developed a typical case of yellow fever. The source of infection in this case must, therefore, be attributed to the injection of blood drawn from the patient in whom the disease was progressing rather than the filtered serum with which he had been inoculated one week before. It seems clear also that the blood injected contained the specific organisms, which had therefore passed through the filter along with the filtrate



with which this later individual had been inoculated. Walter Reed (Amer. Medicine, Feb. 22, 1902).

That the pathogenic element of the disease may be transmitted by contaminated mosquitoes is now an established fact. Carlos Finlay more than twenty years ago, before the Sanitary Conference at Washington, said: "It is my personal opinion that three conditions are necessary in order that the propagation of yellow fever shall take place: 1. The presence of a previous case of yellow fever within certain limits of time. 2. The presence of a person apt to contract the disease. 3. The presence of an agent entirely independent for its existence both of the disease and of the patient, but which is necessary in order that the disease shall be conveyed from the yellow-fever patient to a healthy individual." Before the Academia de Ciencias Medicas Fisicas y Naturales de la Habana he also read the following lines: "Yellow fever, at times, will travel across the ocean to be propagated in distant ports, while at other times the disease seems unable to transmit itself outside of a very limited zone. Once the need of an agent of transmission is admitted as the only means of accounting for such anomalies, it is evident that all the conditions which have hitherto been recognized as essential for the propagation of the disease must be understood to act through their influence upon the said agent. The fact of yellow fever being characterized both clinically and histologically by lesions of the blood-vessels and by alterations in the physical and chemical conditions of the blood suggests that the agent which conveys the infectious particles from the patient to the healthy should be looked for among those insects which drive their sting into blood-vessels in order

to suck human blood. Finally, by reason of other considerations which need not be stated here, I came to think that the mosquito might be the transmitter of yellow fever."

Experimental investigations have amply confirmed this logical deduction. Walter Reed and James Carroll, of the United States Army, and Aristides Agramonte, of Havana, conducted a series of tests in 1900 which conclusively showed that the mosquito was the agent of transmission. The principal experiments of these investigators are the following: They obtained the consent of 16 non-immune men to permit experimentation. Of these, 4 were injected with blood from yellow-fever patients and 12 were subjected to the bites of mosquitoes that had bitten patients suffering from yellow fever from twelve to fifty-seven days previously. These 16 subjects developed yellow fever. The period of incubation brought about by the subcutaneous injection of blood was shorter by twenty-five and one-half hours than that occasioned by the mosquito-bite. By the former method this stage developed in from forty-three to ninety-four hours, while in the mosquito infection it was from seventy to one hundred and forty-six hours. After the mosquito-bite, the largest number of cases, 9, occurred on the fourth day. The experiment demonstrated that the poison is present in the general circulation both before and after the stage of remission. The mosquito used was the *Culex fasciatus* (*Stegomyia fasciata*). In individuals bitten by five *Culex pungens* the fever did not develop. One case was bitten by fourteen mosquitoes hatched from the ova of a mosquito that had shown itself capable of conveying the disease, with a negative result. Patients bitten by mosquitoes within 12

days after they had filled themselves with blood of the diseased failed to communicate the disease.

As a result of their investigations, Drs. Reed, Carroll, and Agramonte reached the following conclusions: "1. The mosquito—*Culex fasciatus*—serves as the intermediate host for the parasite of yellow fever. 2. Yellow fever is transmitted to the non-immune individual by means of the bite of the mosquito that has previously fed on the blood of those sick with this disease. 3. An interval of about twelve days or more after contamination appears to be necessary before the mosquito is capable of conveying the infection. 4. The bite of the mosquito at an earlier period after contamination does not appear to confer any immunity against a subsequent attack. 5. Yellow fever can also be experimentally produced by the subcutaneous injection of blood taken from the general circulation during the first and second days of this disease. 6. An attack of yellow fever, produced by the bite of the mosquito, confers immunity against the subsequent injection of the blood of an individual suffering from the non-experimental form of this disease. 7. The period of incubation in thirteen cases of experimental yellow fever has varied from forty-one hours to five days and seventeen hours. 8. Yellow fever is not conveyed by fomites, and hence disinfection of articles of clothing, bedding, or merchandise, supposedly contaminated by contact with those sick with this disease, is unnecessary. 9. A house may be said to be infected with yellow fever only when there are present within its walls contaminated mosquitoes capable of conveying the parasites of this disease. 10. The spread of yellow fever can be most effectually controlled by measures di-

rected to the destruction of mosquitoes and the protection of the sick against the bites of these insects. 11. While the mode of propagation of yellow fever has now been definitely determined, the specific cause of this disease remains to be discovered."

Many obscure features of the general problem of transmission of the pathogenic element are thus elucidated. It has often been observed that yellow fever developed among stevedores at New Orleans a few days after they had unloaded a vessel from Havana on board of which no case of yellow fever had been observed. Contaminated mosquitoes brought with the cargo now easily account for this result. It was noted that infection of the stevedores could be avoided by burning sulphur in the holds of the ships before discharging the cargoes. It is easy to understand now that it was the contaminated mosquitoes that were destroyed by the sulphur dioxide. In 1878, while at Fort Barancas, a ship with yellow fever aboard passed the fort, but there was no communication with her. Within two weeks several cases of yellow fever occurred in different localities, and the only explanation was based upon the theory that something had washed ashore from the ship and lodged on the beach. There was a similar occurrence at Governor's Island in 1870, a contaminating agency having come from the ships anchored off the shore which caused an outbreak of yellow fever. It is now plain that in both instances mosquitoes carried the infection from the ship to the shore.

As recently emphasized by Finlay, the transportation of the *Culex fasciatus* in sailing vessels must have been of frequent occurrence, and to this must be ascribed the coincidence of the severe epidemics noted in widely separated



countries. This fully sustains the opinion of Surgeon H. R. Carter (Yellow-Fever Institute Bulletin No. 9, P. H. and M. H. S.), when in answer to the view expressed by Health Officer Doty, of New York, that ships do not become infected with yellow fever, he wrote, "the ability of a vessel to carry the infection of yellow fever is no myth," after giving a list of thirteen vessels which had done so at a single station during the short period of three years. Surgeon Carter recognized two methods by which a vessel can become infected: 1. A case of yellow fever contracted elsewhere may develop aboard a vessel already harboring *Stegomyia (Culex fasciatus)* mosquitoes which become contaminated from it. 2. The *Stegomyia* mosquitoes may come aboard already contaminated.

The endemic foci of yellow fever in America, from the pre-Columbian times to the beginning of the seventeenth century, were comprised within a zone between the twentieth and the eighth or ninth parallels of north latitude, reaching, toward the east, as far as the Leeward Islands and limited toward the west by the Atlantic Coast of the American continent. During the seventeenth century that zone extended farther north up to the twenty-third parallel and southward to the parallels at Bahia and Pernambuco. Finally, in 1850, it reached Rio Janeiro. The transportation of the mosquitoes of the yellow-fever-carrying species in sailing vessels appears to have been of frequent occurrence, ever since the early times of the discovery of America. To it probably is due the coincidence of the severe epidemic of the so-called "modorra pestilencial" in Santo Domingo in 1494, with another very fatal epidemic of the same name in the Canary Islands the same year. Apart from the conveyance of contaminated mosquitoes, healthy ones must have been frequently imported into subtropical countries, where they are found now to exist, having accli-

mated themselves to their new abodes. This is known to be the case in Italy, in the south of Spain, and other coasts of the Mediterranean, as well as in the south of the United States and in other countries. The previous existence of the yellow-fever-carrying mosquito must be considered, *per se*, to constitute a dangerous complication whenever a case of yellow fever happens to be introduced into a place usually free from that infection. The range of the Andes, and its prolongation along the Isthmus of Panama and Central America, appears to have stood as a barrier, protecting to some extent the western coast of America against the migration of contaminated mosquitoes. That obstacle, however, is about to disappear when the Panama or the Nicaragua Canal comes to be opened; let us hope, therefore, that, by that time, through the joint efforts of all the nations interested, all the existing foci of the disease will have been extinguished and that the adoption of measures, similar to those which have proved so successful in the hands of our sanitary department, will henceforth provide reliable means for controlling the propagation of yellow fever. C. Finlay (Jour. Amer. Med. Assoc., April 19, 1902).

The reasons for believing that the only way in *nature*, by which yellow fever can be propagated is by the mosquito, are seven: 1. Havana has been freed of yellow fever and has remained so for the past fourteen months, and this result was accomplished by basing all the sanitary precautions on the theory of the mosquito origin of the disease. That the brilliant results obtained were not a mere coincidence is proved by the fact that never before, in a period of about one hundred and forty years, has this occurred. 2. That an infected mosquito is capable of giving the disease has been proved by twenty-one actual experimental inoculations upon human beings. That the cases of diseases so produced were really cases of true yellow fever is proved, first, by the fact that the confirmatory diagnosis was made by an expert commission; and, secondly, that three of the inoculated

subjects died and the autopsies performed upon them showed all the characteristic lesions of yellow fever. 3. The elaborate experiments undertaken with the object of trying to infect people by bringing them in contact with infected fomites all proved negative, yet the subjects of the experiments were all carefully selected non-immunes, and some of them subsequently contracted yellow fever. 4. The mosquito theory of the propagation of the disease is the only one that is capable of satisfactorily explaining all the facts that are known concerning the disease. 5. That other parasites are not capable of transmitting the disease is shown by the fact that the successful crusade against yellow fever in Havana was conducted by waging war upon the mosquito alone, and, during the whole period that the disease has been kept under, Havana has been harboring a non-immune population of some 40,000 souls, while being infested, as it always is, with bedbugs and fleas. 6. Analogy is against the supposition that other parasites could be capable of propagating the infection. All the other diseases we know of that are transmitted by a parasite are capable of being transmitted only by a specific parasite and in no other way. 7. All who witnessed the experiments with yellow fever and who by education were capable of forming a scientific opinion believed that the mosquito was the parasite that conveyed the disease, and that there was no other way by which the disease could, by nature, be transmitted. J. W. Ross (Medical Record, Jan. 24, 1903).

Sir William Ferguson, in South Africa, observed that the fever was conveyed by vessels. The period of incubation ranged from eleven and one-half to twenty-seven days. The mosquito theory was first advanced in 1881. Finlay discovered the theory and found that patients bitten by the mosquito of ships infected with the fever contracted the disease. The germ has to go through a life-cycle in the mosquito, similar to that of the *Plasmodium malarix*. Various experiments were made, but in no case could the disease be produced by

the insect kept less than twelve days. Parasites must be present in the peripheral blood of the patient for the insect to become infected. In August, 1899, sixty deaths from yellow fever occurred in Tampa, Fla. In August, 1901, an epidemic, in which three died, occurred in Santiago, by infection through an infected mosquito. Yellow fever is produced only and solely by the mosquito. S. E. Chaillé, of New Orleans, stated that the female *Stegomyia* mosquito can convey the germ. Isolate every patient and the disease will be destroyed. Isolation is necessary. This was proven in Havana, not one case occurring in the last three years. Other Cuban cities have escaped yellow fever without waging effective warfare on mosquitoes. The greatest duration of eleven infected *Stegomyia* was an instance in which one lived until the one hundred and fifty-fourth day. It is yet to be determined how long a *Stegomyia* may live under exceptional circumstances. By the destruction of mosquitoes the disease has been mitigated. New Orleans, La., could furnish many instances when the disease was introduced. Fomites failed to infect persons after they had been infected. Without *Anopheles* malaria does not occur, although the disease has been attributed to water and watermelon. The blood of a yellow-fever patient is infected four days after the attack. The conviction gained ground that yellow fever was an infectious disease. Infection by fomites was supposed and they were believed to carry the disease. More places than New Orleans have suffered. General Ben Butler demonstrated that the disease could be eradicated by cleanliness. He was heartily indorsed by the doctors, public, and press. *Stegomyia* is the sole cause of yellow fever. J. Carroll (Proc. Amer. Med. Assoc.; Phila. Med. Jour., May 16, 1903).

The practical bearing of the discovery that mosquitoes transmit the pathogenic principle of yellow fever is well illustrated in the following editorial which appeared in the Medical News, of November 15, 1902: "No more interesting



story in the history of medicine has ever been told than that related by Major Gorgas, United States Army, formerly Chief Surgeon of Havana under the United States authorities, with regard to the disappearance of yellow fever from that city. Everyone knows how the Army Medical Department after the American occupation of Havana succeeded in reducing the death-rate of that city from 91.03 during 1898, the last year of the Spanish possession, to 22.11 for 1901, the last full year of American occupation. Eighteen hundred and ninety-eight was a war-year and its death-rate was undoubtedly abnormally high; but the death-rate in Havana for ten years before the American occupation was nearly 45. During the last three months of United States rule, just before the management of affairs was handed over to the new Cuban government in April (1902), the death-rate was scarcely more than 17, which is considerably lower than that of some of our own United States cities.

"Notwithstanding the improvement in sanitation in Havana, however, the mortality from yellow fever did not decrease for several years. There were over 130 deaths from the disease during 1898, over 100 deaths in 1899, and nearly 300 deaths in 1900. Old inhabitants of the city smiled knowingly and said that yellow fever rather liked sanitary surroundings. Some of them hinted that the new-fangled notions of the Americans would only prove fosterers of suitable breeding conditions for the awful scourge the Cubans knew so well. This was the state of affairs when it was resolved to put into practice the theory that yellow fever is a mosquito-borne disease.

"During the year 1900 yellow fever was prevalent particularly among mem-

bers of the upper classes, and some of the most intelligent members of the community were afflicted. Sanitation alone had evidently failed to lessen the danger from disease. Men who could be absolutely depended on to take every possible precaution known in order to avoid all ordinary means of infection, were stricken by the disease. Practically one-half of the members of the Governor-General's staff died from yellow fever during this year. If anything were to be done, it had to be done at once and no expense should be spared.

"A system of inspection was initiated by which within two hours after the report of a case of yellow fever the patient was thoroughly protected from mosquitoes by close netting. The whole house in which the patient lived was fumigated by burning pyrethrum powder, and all the mosquitoes' bodies swept up and burned, because it was found that sometimes the insects were only rendered comatose and subsequently recovered. The houses in the immediate neighborhood were also fumigated in the same way. Besides this, all standing water, whether in cisterns, vessels, or pools, was drained off, in order that it might not form a breeding-place for the larvæ of the *Stegomyia fasciata*, the mosquito which is believed to carry yellow fever. Swamps that could not be drained were treated with petroleum.

"The effect of these measures was very soon felt. The mosquito crusade was begun in February, 1901. During that month there were five deaths from yellow fever. In January there had been seven deaths from the disease. In March there was but one death. In April no deaths from yellow fever occurred, and the same favorable state of affairs continued during May and June. In July there was one death from the

disease and then, after a month of freedom from the affection, a single other death from it in September. Since September, 1901, there has been no death from yellow fever contracted in Havana. This is, indeed, a triumph of sanitation—a landmark in the history of sanitary science.

"There were two places on this continent where yellow fever was endemic—Havana and Rio Janeiro. Now one of these permanent foci of infection for other places has been taken out of the fell partnership, and the method by which it has been accomplished will prove a lesson that the other, Rio Janeiro, will not long neglect. It is probably only a question of a comparatively short time when yellow fever will be a memory, a nightmare of dread in medical reminiscence, but robbed of its terrors.

"The Army Medical Department is to be congratulated on the work it has accomplished. As we pointed out some time ago, this is only one of many things for which it deserves hearty tribute of praise. There is a lesson for the country in general in the matter, however, that physicians should not neglect to point out. The benefits that accrued to Havana are mainly due to the fact that the sanitary authorities were given a free hand and that the physician Governor-General not only did not hamper their work, but stimulated and encouraged them to the limits of his power. Already the cost of the war in lives and treasure has been saved many times over by the sanitary improvements effected. If those who raise opposition to the introduction of sanitary regulations could only be made to understand how much they hamper the progress of a great humanitarian work there would soon be many causes for congratulation because

of ameliorated hygienic conditions. If there were medical officials with ample authority, as in Cuba during the American occupation, then the obliteration of many physical evils might be expected here in the United States too. For one thing, much might be accomplished without undue delay for the improvement of the condition of the tuberculous poor and, as a consequence, of tuberculosis in the whole population. . . . It is almost impossible to foresee the extent of hygienic benefit that might result therefrom. The yellow-fever success could not have been anticipated two years ago, and without special government encouragement the problem might have remained unsolved for years."

Patients visiting infected houses long after the disease is supposed to have disappeared have suffered from attacks of yellow fever. The interval between the infecting cases and the first and secondary cases are habitually considerably greater than the period of incubation of yellow fever. Yellow fever is then not contracted in any of these houses by those residing continually in them until a considerable time (in days) after the development of the infecting cases, although those same inmates had contracted the disease in the same houses. Later cases of yellow fever which occurred aboard ship after detention at marine and quarantine stations have not been followed by others among the crew. Cases of yellow fever which occur in houses disinfected soon after were not followed by other cases among the inmates. Cases of yellow fever which occurred in houses vacated soon afterward have not been followed by other cases from inmates leaving, although cases occurred among those who remained in the houses or in the neighborhood.

Cases of yellow fever which occur in clean houses are not often followed by other cases among the inmates exposed to no other infection until after such



time as shows that the disease was not contracted for a number of days after the development of the first case, although the same inmates had developed yellow fever from these same houses later. It is evident that a knowledge of the interval in a sufficient number of instances is sufficient to determine approximately the usual period of intrinsic incubation. From ten to seventeen days after the development of the infecting case seems to be about the usual limits for contracting the disease by the first of the secondary cases when there are many of such cases in a house. H. R. Carter (Medical Record, June 15, 1901).

**Treatment.** — The therapeutic measures indicated in yellow fever herein described are recommended by Passed Assistant Surgeon H. D. Geddings, of the Marine-Hospital Service.

For the relief of the chill and subsequent fever, the distressing headache and pain in the back, loins, and limbs, it is believed that the old plan of administering a hot foot-bath containing mustard is an eminently proper one. The bath hastens reaction from the chill, markedly relieves the headache and pains in the back and legs, and promotes diaphoresis. The patient, being then restored to bed, should be covered warmly, but not too heavily, and gradually uncovered as diaphoresis proceeds, in order to avoid undue prostration. Care should be exercised to prevent sudden chilling of the surface.

As soon as the patient is made comfortable in bed the remedial treatment should be begun. At this stage this should consist of a sharp purge, preferably mercurial. I have found calomel, 5 grains; compound powder of jalap, 10 grains; administered in capsules, most efficient. Others prefer the compound cathartic pills (U. S. P.), of which 1, 2, or 3 may be administered, according to the age and general condition of the

patient. Should either of these remedies fail to move the bowels freely within six or eight hours, it may be followed by a moderate dose of castor-oil, a Seidlitz powder, or a bottle of citrate of magnesia.

Closely following the first purgative should be administered one of the coal-tar febrifuges: phenacetin,  $7\frac{1}{2}$  grains, or antipyrin or antifebrin, 10 grains; either of which may with advantage be combined with  $1\frac{1}{2}$  to  $2\frac{1}{2}$  grains of citrate of caffeine. By the use, in moderate doses, of the coal-tar products at the inception of the attack, we relieve headache and the racking pain in back and limbs, diminish restlessness, and reduce temperature considerably. The action of the first dose of the antipyretic appears to furnish, in some sort, an index of the course of the particular case under observation. If after the administration of the antipyretic the patient passes into an easy sleep and wakes with diminished headache and other pains, a moist skin, and a reduced temperature, there is reason to believe that the case may be mild or of moderate severity, and will end in recovery. If, on the contrary, the antipyretic produces but slight influence on the temperature, where restlessness is not diminished or controlled, where pain persists, and the skin, though moist, has a burning, pungent feeling, the worst and trouble to the very end are to be feared. Repeated doses of the antipyretic are not needed, or indeed indicated. One, two, or, at most, three doses in the first twenty-four hours of the disease will accomplish all that is to be gained from this series of remedies. Administered later in the disease, they exercise too depressing an effect on a heart already weakened as a consequence of more or less profound toxæmia.

The gastric irritability, which is often extreme at the onset of an attack of yellow fever, may be controlled by sinapisms to the epigastrium, abstention from fluids, and frequent ingestion of small pieces of ice, which not only allay thirst, but also tend in themselves to relieve nausea. Should the latter or vomiting persist, the administration of cocaine hydrochlorate, in doses of  $\frac{1}{4}$  grain to  $\frac{1}{2}$  grain every hour or two, will often act almost magically. Small quantities of carbonated beverages, as Vichy, Seltzer, or Apollinaris water, ginger-ale, or very dry champagne, administered ice cold, will often prove of service. Creasote has also been highly recommended, and also a mixture containing hydrocyanic acid and morphine. Considerable relief is also derived from the application to the epigastrium of a liniment composed of olive-oil and menthol.

On the afternoon of the second or morning of the third day the presence of albumin in the urine may be noted, unless the case be of the most ephemeral mildness. The quantity present on first detection, and its increase or diminution from day to day, form, perhaps, a fairly good guide to prognosis. If it appears, increases gradually, and then begins to diminish, prognosis is good. If, on the contrary, it appears at first in large amount, persists or increases abruptly, trouble may be anticipated.

How shall we best treat the condition resulting in black vomit? The problem being both to arrest vomiting and to treat the condition giving rise to it, it follows that treatment should be directed toward the general hæmorrhagic diathesis. Probably the most efficient remedy is found in the tincture of the perchloride of iron. That should be given in large doses, 15 to 30 drops

every hour or two, or, if vomiting is frequent, after each act of emesis. Counter-irritation to the epigastrium, the administration of stimulants, preferably champagne or good brandy administered in carbonated water and given cold, swallowing of ice, and administration of cocaine, make up about the sum of our remedial agents. While enough has been said to show that black vomit is a most serious symptom, it does not follow that every patient who vomits black matter will necessarily die. A fair proportion of cases recover after the symptom has manifested itself. Still, the ejection of black vomit makes a most profound mental impression on a patient, and for this reason has often hastened a fatal termination in a case which, up to the appearance of this accident, had done well.

Of far graver importance is the train of symptoms which leads to uræmia, and which are announced by partial or complete suppression of urine. This is probably the gravest accident that can happen in the course of yellow fever. The amount and character of the urinary secretion should be a matter of frequent inquiry in every case, grave or mild, from the inception to convalescence. A sudden and irregular increase in the amount of albumin should put us on our guard against possible urinary suppression, and prompt treatment should be instituted and maintained. Counter-irritation over the region of the kidneys with turpentine or mustard, dry cups, the application of hot-water bags, all should be tried. A *tisane* of water-melon seeds has long enjoyed the reputation of being almost a specific among the creole population of New Orleans, and I can bear personal testimony to its efficacy alone or given in combination with spirit of nitrous ether. Of almost



equal reputation is a *tisane* of orange-leaves, preferably of the bitter variety, given in large quantities and frequently. In cases of suppression or very decided diminution of the urinary secretion, high enemata of cold water will often produce an abundant secretion and evacuation of urine. The practice being free from all danger, the expedient is certainly well worth a trial.

A remedy much used in Brunswick in 1893, and vaunted as almost specific by those very successful in the management of the disease, was spirit of turpentine, which was sometimes given in heroic quantity, as much as a teaspoonful at a dose and repeated. The results claimed for it warrant its more extended use. A failing heart should receive appropriate stimulation. Alcoholics should be freely used; ammonia in the form of the aromatic spirit should be exhibited for its well-known diffusible stimulating effects, but its irritating effects upon the stomach should also be borne in mind, and hypodermic injections of strychnine, pushed to the extreme limit of tolerance, should be used in cases where a fatal issue through the circulatory apparatus seems to threaten. It has often seemed desirable to make use of inhalations of oxygen in cases where failure of heart and respiration seems to threaten as a result of uræmic poisoning.

An important feature in the treatment of yellow fever is the frequent washing out of the lower bowel with enemata of warm water and soap. Constipation is the rule, and no one who has noted the exceedingly fœtid, almost putrid, character of the stools of a yellow-fever convalescent can fail to see the wisdom of removing the chances of septic absorption by frequent washing away of this fermenting mass. A well-oiled

rectal tube should be passed as far up into the bowel as possible, and with a fountain-syringe elevated not more than a foot or two, 2 or 3 pints of warm, soapy water should be injected into the bowel. The whole operation should be performed with the patient upon a bed-pan, not seated upon a vessel or close stool. The effect upon the temperature and general condition of the patient is most marked.

Quinine or allied preparations are generally known to possess no specific effect. But as yellow fever almost always occurs in regions where malarial diseases are also rife, and as the inter-currence of a malarial paroxysm is one of the most disagreeable incidents that can mar the course of a case, it is good practice in such regions to administer 30 to 45 grains of quinine or cinchonidia in the first twenty-four hours, exhibiting the drug per rectum if the stomach is irritable.

The writer found that a tincture or fluid extract of the seed of cedron was used in Central and South America as a specific antidote to persons suffering from stings or bites of insects or snakes. While at Jiminez, Costa Rica, the writer attended nine laborers who had yellow fever. He gave them a tincture of the cedron-seed prepared by himself and of uncertain strength. He employed hypodermic injections of about 20 minims (1.3 cubic centimetres) three times a day. The drug promptly relieved the headaches and stopped the nausea. All the patients recovered. S. H. Hodgson (Medical Times, Oct., 1901).

**DIETETIC MANAGEMENT.**—A most important point in the management of yellow fever is the diet. Many a patient, his crisis past and the borders of convalescence reached, has been hurried into an untimely grave by the misplaced kindness of an apparently simple meal. The yellow-fever patient should never

be starved; on the contrary, he should be well nourished, but the most scrupulous care should be exercised in the selection and administration of his diet. "A little and that often" should be the rule. For the first few days milk with lime-water, given cold; then animal broths, concentrated, but free of fat, should be the regimen. The fever being reduced, soft-boiled eggs, milk-toast, and small bits of the white meat of chicken and tenderest steak may be permitted. Probably at least ten days or two weeks should elapse before the convalescent, by the easiest stages possible, should resume ordinary diet.

**Management of Epidemics.**—Before going extensively into details let me explain that there are parts even of the southern portion of the United States which are known to practical sanitarians as "non-infectible territory." These are, generally speaking, high and mountainous sections of the South where experience has shown that yellow fever will not naturally spread if introduced. This immunity, while long recognized, has never until quite recently been satisfactorily explained. We now have reason to believe that it is due to the fact that mosquitoes of the genus *Stegomyia fasciata* do not naturally exist in these localities, or, if introduced in cars, sleeping-coaches, baggage, or freight, do not there find the conditions necessary to their longevity or propagation. Consequently, even if actual cases of yellow fever should be introduced into these regions, or should declare itself in refugees after arrival, there would be no spread of the disease, as there would be no *Stegomyia* to become infected.

The geographical distribution of the *Stegomyia*, while not accurately determined, is fairly well known, and it is an interesting fact that a study of a contour

map of the United States shows that the "non-infectible territory" corresponds almost completely with the regions beyond the habitat of this particular variety of mosquito.

As examples, St. Louis, Mo.; Atlanta, Ga.; and Huntsville, Ala., may be mentioned as localities where, on account of the elevation, character of the soil, drainage, etc., the disease, though from time to time introduced, has never spread.

The work principally involved in suppressing the disease is in isolation and disinfection for the destruction of possibly infected mosquitoes. If the first case is discovered it is within our power to limit it to the house in which it prevails, the first effort being to prevent the room and the house itself from becoming infected. This may be arrived at by carefully screening the case from the bites of mosquitoes, and by fumigations practiced from time to time to destroy such of the insects as may have eluded our vigilance.

If the disease has prevailed for some time, and persons have had free ingress and egress, it becomes necessary to take those persons and hold them under observation a period of ten days to see whether they will develop yellow fever. One can readily imagine, in a district where it has been allowed to run along for some weeks, how difficult it is to trace all the people who have been exposed to infection. Difficult as it is, this is attempted and frequently with unsuccessful results. An examination is at once begun of surrounding houses and neighboring villages, particularly along the line of a railroad, to see whether the disease may be anywhere co-existent. If the disease prevails in a considerable number of houses, there is no doubt that an excellent plan is to



remove the sick to a hospital, though great care must be exercised in moving them, and taking the well to a detention camp, and then disinfecting the vacated premises to destroy mosquitoes.

While panic and alarm are to be avoided, there is no doubt that it is safer for those who have not been exposed and in the interests of the suppression of the spread of the epidemic, inasmuch as it removes the material on which it may feed, if people will leave. At this time the railroads are taken charge of by the sanitary authorities, and the leaving must be under sanitary regulations. Those who have not been exposed to infection may depart when this is absolutely proved. Those concerning whom there is some doubt may go on through trains to the non-infectible territory, where they must report and be kept under observation for a period of ten days. Those who are known to have been exposed must be taken to a detention camp, there to be held ten days until they have demonstrated their freedom from infection, when they may be allowed to depart. If a city or village is infected, and its dimensions will allow of a cordon being placed around it, this is done, and no one is allowed to leave except under these conditions. This was done at Brunswick, Georgia, there being guards on land and revenue cutters on the water-front to prevent egress except through the detention camp, twenty-five miles off, where every provision was made for the comfort of the people undergoing detention. When the city is too large to be thus surrounded the outgoing trains are under sanitary surveillance, and no tickets are allowed to be sold except to persons who have certificates that they have been under observation for ten days, and are free from

the disease, or unless the ticket is one which leads clear through to non-infectible territory, and the baggage of all these passengers must be subjected to close scrutiny, and if it is suspected or proved that it harbors mosquitoes, it must be subjected to a process of disinfection sufficient to insure their destruction.

Now, Atlanta, as I have said, is in the non-infectible territory, and if yellow fever prevails in New Orleans people who are believed, though not positively known, to be free from infection, are given tickets to Atlanta, and their baggage disinfected. Now, what is to prevent these people at Atlanta immediately taking the south-bound train and returning into the infectible territory where, if the disease should appear, it would be likely to spread? This is managed through the railroad officials, who require a certificate from the Marine-Hospital officer stationed at Atlanta of every person wishing to buy a ticket for a point south—say, Florida—that he has been in Atlanta ten days, and is entirely well, and that the baggage he brought with him from New Orleans has been disinfected. Furthermore, on the trains leaving the infected city there are train-inspectors appointed with a view to recognizing quickly any chance cases of the disease and to prevent any persons boarding the train who might leave the city, and try to board it at some outside point, and to see that the passengers go through to the non-infectible localities. This train-inspection service, I have found, is very efficient in checking the spread of the disease. Its details can hardly be gone into here, and it is sufficient to say that the inspectors have certain runs and relays, so that those going from an infected territory return into the infected territory, delivering

their passengers to those who come from the non-infected territory, who carry them through to the non-infectible territory. At the same time a classification of freight is made, and such as may carry infection (that is, such as may harbor infected mosquitoes) is disinfected before being allowed to leave the infected city.

It appears certain that neither the handling of nor contact with yellow-fever patients nor the performance of necropsies is capable, *per se*, of conveying the disease to non-immunes. It appears probable that general ships' cargoes and the fomites of patients are also not directly infective. It seems to be fairly definitely established that a yellow-fever patient may become a danger by infecting the premises in which he is placed. In such an infected house an interval of about fourteen or twenty-one days obtains before the first secondary cases occur. This prolonged interval is suggestive of a development of the infecting factor in or about some agent or matter in the house, the nature of which is not yet demonstrated. H. E. Durham and Walter Myers (Brit. Med. Jour., Sept. 8, 1900).

Before closing this part of the subject I wish to dwell upon the importance of recognizing the first case. It need not be announced with a flourish of trumpets to alarm the people, but it should be announced to the proper authorities as soon as it is found. The cause of so much panic being produced by yellow fever is the fact that it is so frequently concealed until concealment is no longer possible, by which time there is cause for panic. But if promptly reported there should be no more cause for fear than is caused by a case of small-pox or cholera.

The disease of late years has been so mild that there has been much doubt as to the nature of the first cases, but

these can be determined upon and taken care of. I might say there has been too much written and said about yellow fever. The subject should be made less of by the daily press. The public authorities should be promptly advised of the appearance of the disease and take prompt charge, and when this is done there need be no more fear or panic than is caused by other diseases.

**Disinfection.** — Disinfection of clothing, bedding, and fabrics or textiles, exposed during the course of a case of yellow fever, is not necessary in the light of recent investigation and discovery.

The problem has resolved itself into a campaign against the mosquito (*Stegomyia fasciata*), and efforts should be directed (*a*) to the destruction of the insects about a house where yellow fever prevails, and (*b*) against their propagation in a locality where the disease has manifested itself.

The destruction of the insect may be accomplished by fumigations with pyrethrum powder, or with sulphur dioxide, 2 to 2½ pounds of sulphur being burned for each 1000 cubic feet of space. In using pyrethrum the bodies of the insects should be swept up and burned, as this agent does not always kill, but simply stupefies or partially asphyxiates. The sulphur dioxide is, on the contrary, a true insecticide.

The propagation of mosquitoes may be limited or prevented by the draining or filling up of ponds, pools, or collections of stagnant water, by the screening of water-barrels, cisterns, and tanks, preventing the ovipositing of the female mosquitoes, or by the destruction of the larvæ and pupæ by the application of petroleum.

Grounds should be drained, weeds cut down and burned, and the grass of lawns kept closely cut, destroying harboring



places for fully developed insects, and effecting a drying of the soil and rendering it less fit for the propagation of the pests. The subject has therefore resolved itself largely into a question of house and communal sanitation.

The methods pursued in Havana, Cuba, in stamping out yellow fever are summarized by Dr. Charles J. Finlay, Chief Quarantine Officer of Havana, in an address before the Conference of State and Provincial Boards of Health of North America, New Haven, Conn., October 28, 1902. Dr. Finlay is quoted as follows:—

“That the essential conditions for stamping out yellow fever from an infected locality are: (1) to protect yellow-fever patients from the bites of the special yellow-fever mosquitoes; (2) to destroy all mosquitoes which may have reached yellow-fever patients; (3) not to allow non-immunes to enter the infected zone until the last of the contaminated insects may be supposed to have died; (4) to lessen the chances of propagation by adopting adequate measures calculated to prevent the multiplication of mosquitoes in general.”

Dr. John Guitéras, in a paper read before the First International Sanitary Congress of American Republics, Washington, D. C., in December, 1902, on “Prophylaxis against Yellow Fever,” describes the following as the method adopted in Havana for the safe management of a case of yellow fever:—

“The room occupied by the patient is at once closed by wire gauze. False windows and doors of all sizes are provided by the department, and they are at once adjusted to the openings in the room. One person, as nurse, is allowed to remain in the room, and a guard is placed at the wire-gauze door. The latter, and other openings that may communicate

with other apartments in the house, are temporarily closed with stout manila paper in order to prevent the entrance of pyrethrum smoke in the room occupied by the patient. The rest of the house is now fumigated. To do this all compartments are carefully closed. Strips of paper are pasted over all cracks. Even open halls and courts are closed with screens of manila paper. A good deal of ingenuity is displayed in rapidly constructing and putting together these improvised screens, so that the most irregular and open places are converted into closed chambers hermetically sealed against the exit of smoke and mosquitoes.

“After the fumigation of the house the patient is transferred to one of the fumigated rooms, previously closed with wire gauze, and the sick chamber is then disinfected in the same manner. Neighboring houses, unless evidently incommunicated with the infected house, are treated in the same way. As previously stated, the process is often much simplified by removing the patient to Las Animas Hospital.

“The routine of disinfection is as follows: The inspector or chief of the squad assigns one man to each of the windows or openings in the room. The duty of each man is to close the opening perfectly by pasting strips of newspapers over all cracks and joints. Upon completing his work he must write his initials on the window-frame. While this is being done the inspector has measured the cubic space of the room. If possible, an opening is left somewhere for the admission of light; it may be a glass pane or an opening covered with manila paper. On the window-sill or floor beneath this opening a sheet of moistened white paper is placed. It has been found that the mosquitoes, during

the fumigation, flock toward this opening, and when paralyzed by the smoke they are apt to fall upon the paper below, where they can be more easily gathered afterward. The pyrethrum powder is now placed in pans and ignited by setting fire to a small amount of alcohol in each pan. One door has been left open for the exit of the men. Before leaving all clothing is shaken and scattered about the room. The exit door is now closed from the outside, its joints and cracks are pasted over, and the seal of the department is placed upon the strips of paper. Pyrethrum is burned in the proportion of 1 pound to every 1000 cubic feet of space.

"At the expiration of four hours the squad returns and the door is partially opened to allow the men to enter. The walls, ceiling, and floor are carefully swept, and the clothing is once more shaken. Any mosquitoes found to be still living are thrown into the pans and those that are dead are kept in small boxes to be sent to the laboratory of Las Animas Hospital for identification.

"Petroleum is now poured into all receptacles where mosquito larvæ may grow. The inspector meanwhile makes an inquiry as to the place where the patient may have been infected, the places he visited in the last five days previous to his illness, and the persons that are likely to have been bitten at the same time and place with the patient.

"The inspector takes also a census of the non-immunes who live in the house and its immediate neighborhood. All this information is made the subject of a report to the city health officer. The report should contain also any recommendations that may be deemed useful as to the general sanitary condition of the house.

"The Health Department of Havana is prepared to disinfect, in the manner above described, twenty-four houses in one day. As many as twenty-two have been disinfected with an expenditure of five hundred pounds of pyrethrum.

"Before leaving the house a certificate is obtained from the family to the effect that no damage has been done to the property in the process of disinfection, or, if otherwise, a note is taken of complaints that may be made.

"With respect to the pyrethrum powder, it should be stated that the smoke does not kill all the mosquitoes; but at the end of four hours those that are not killed are paralyzed and can be readily gathered in the manner I have described. The smoke produces, also, a very faint cast upon exposed surfaces of white goods when they are lying in a horizontal position. Tobacco is as effective as pyrethrum, but it leaves a very offensive odor and a more decided stain than pyrethrum. Guava leaves have also been tried, but they are less effective."

Even in a filthy tropical city, without proper sewerage, without any sanitary standard whatever, the work of disinfection can be pushed to a successful issue.

This fact is fairly in evidence; the foci of yellow fever are in certain definite places in a city where it is endemic. The habitat can be located, and as fast as one appears it should be guarded closely, and, with all of its belongings, disinfected thoroughly, and, as an added precaution, redisinfecting at intervals during the danger period; these places should be kept under continual surveillance and treatment, and no pains or expense should be spared to render the contagion at such points inert.

Nearly all of the best men, men of scientific attainments who have had practical experience in the care of yellow fever, and in the sanitation of cities



wherein the fever was epidemic, are now engaged in laboratory work, endeavoring to demonstrate which germ is responsible for this scourge. The object is a most laudable one.

But would not the interests of humanity be better conserved if the sanitary measures in the cities wherein yellow fever is epidemic were under the constant watch and control of some such men?

After an epidemic, this important work—looking to a prevention of a recurrence—is often left in the hands of inexperienced and careless persons. Why should not some of these men devote their entire time and attention to preventive measures, giving intelligent supervision to methods that we have, and know to be reliable? Major L. C. Carr (Phila. Med. Jour., April 6, 1901).

The first special measure of prevention should be to protect the sick individual against the bites of mosquitoes, and the writers state that this can best be accomplished by thorough screening and with immovable screens. As it is possible that mosquitoes that have already bitten the sick individual may have escaped into other apartments of the house, they recommend that these should be closed tightly and subjected either to sulphur or to formaldehyde disinfection or to the fumes of pyrethrum. They regard sulphur as the best agent. In a well-closed room, one to one and a half hours of sulphur fumigation, in a proportion of 1 pound to 1000 cubic feet of air-space, will suffice to destroy all mosquitoes. Reed and Carroll (Medical Record, Oct. 26, 1901).

Procedures carried out in the prevention of this disease: 1. To keep the female *Stegomyia* from biting the yellow-fever patient by having the quarters of the patient entirely screened so as completely to prevent access of mosquitoes. A guard is left at the door to see that the only door communicating with the quarantined area is kept closed and that only those designated by the sanitary authorities have access to the rooms. 2. The destroying of such insects as might have become infected in spite of precautions or before the pa-

tient was screened; pyrethrum powder is burned in all the rooms of the house and in all the contiguous houses, the rooms having first been made as tight as possible and the precaution having been taken to sweep up the mosquitoes from the floor immediately after the fumigation, as pyrethrum does not kill the insects. 3. To destroy the mosquito larvæ systematically, as it was found that the principal points for the breeding of *Stegomyia* mosquitoes were fresh-water collections about the houses of the city. An ordinance was passed requiring all collections of fresh water to be made mosquito-proof. Petroleum was also placed in the cesspools every month, and was also used on marshy ground which could not be drained. Gorgas (Medical News, Jan. 3, 1903).

In closing the subject of the epidemic management of yellow fever, it seems proper to make brief allusion to hopes of what the future may have in store for us in this direction. A glance at the history of epidemic diseases will show that half of the terror inspired by these diseases has been from ignorance of their specific causes. The cause discovered, we know with what we have to deal, and what it is necessary to do. The discovery of the spirillum of Asiatic cholera, by Koch, the demonstration that it was by drinking-water that the disease was most frequently transmitted, experiments showing the slight resistance of the organism to physical agents and chemical disinfection, at once converted a dreaded pestilence into a comparatively simply handled problem. The discovery by Yersin and Kitasato of the plague bacillus threw a flood of light on the means of transmission of the disease and led to the discovery of means for its prevention in the Haffkine prophylactic and its prevention and cure by the Roux-Yersin prevention and curative serum.

The magnificent discovery of diph-

theria antitoxin by Roux and Behring, and the saving of 100,000 lives annually which it has led to in the United States alone, lead us to hope that in the near future we may be in possession of a

similar agent or agents against yellow fever.

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## Z

**ZINC.**—Zincum (U. S. P.) is metallic zinc in the form of thin sheets, in irregular granulated pieces, molded into thin pencils, or in a state of fine powder. Zinc is found as a carbonate, silicate, and sulphide, associated with lead ores in many districts of Great Britain, on the Continent, and in the United States. Zinc is a bluish-white metal, which slowly tarnishes in the air, forming oxide and carbonate of zinc. It has a lamellar, crystalline structure. Zinc unites with the acids and halogens to form salts, of which the acetate, bromine, carbonate, chloride, iodide, oxide, phosphide, sulphate, and valerianate are official.

Acetate of zinc occurs in white, monoclinical plates, having a pearly lustre, and is soluble in 2.7 parts of cold and in 1.5 parts of boiling water and in 36 parts of cold and in 3 parts of boiling alcohol. It possesses a high diffusion power.

Bromide of zinc occurs as a white, hygroscopical, crystalline powder, having a sharp, metallic taste, and is soluble in water, alcohol, ether, and ammonia.

Carbonate of zinc (precipitated) occurs as an impalpable, white powder, of variable composition. It is insoluble in water.

Chloride of zinc (butter of zinc) occurs as a white, deliquescent powder, and is soluble in 0.3 part of water, in alcohol, and in ether. It possesses a high diffusion power. The official solution of zinc chloride occurs as a colorless, astringent,

sweetish, aqueous, liquid, having an acid reaction, containing 50 per cent. by weight of zinc chloride and being miscible in all proportions with water. Burnett's disinfecting fluid is a solution of zinc chloride. Canquoin's paste is made by mixing zinc chloride with flour and water. The strength varies, according to the purpose, from 1 part of the chloride in 6 parts (weakest) to 1 part in 3 (strongest). When used, 10 or 15 drops of water are added to the applications, being made when a large tumor is to be destroyed. The stronger paste may be cut into pointed strips or arrows and dried before using, as suggested by Maisonneuve.

Iodide of zinc occurs as a white, hygroscopical, crystalline powder, having a sharp, saline taste; and is soluble in water, alcohol, and in ether. It possesses a high diffusion power.

Oxide of zinc occurs as a white, amorphous powder, having the property of absorbing carbon dioxide from the air. It is soluble in dilute acids, ammonia, and in ammonium carbonate. It should be kept in air-tight vessels. The ointment of the oxide of zinc (zinc ointment) contains 20 per cent. of zinc oxide.

Phosphide of zinc occurs as dark-gray crystals or metallic lumps, having a faint odor, and is soluble in hydrochloric and sulphuric acids with the evolution of hydrogen phosphide.

Sulphate of zinc (white vitriol; zinc



vitriol) occurs in colorless, rhombic crystals, having an astringent, metallic taste; they effloresce in dry air. It is soluble in 0.6 part of cold and in 0.2 part of boiling water and in 3 parts of glycerin. Villate's solution for treating caries consists of: sulphates of copper and zinc, of each, 15 parts; solution of subacetate of lead, 30 parts; vinegar, 300 parts.

Valerianate of zinc occurs in white, glistening laminæ, having a valerianic-acid odor and a sweetish taste, and decomposing on exposure. It is soluble in 40 parts of alcohol and in 100 parts of water.

**Preparations and Doses.** — IRRITANT (SOLUBLE).—Zinci acetas (U. S. P.), 2 to 6 grains.

Zinci chloridum (U. S. P.), 1 to 2 grains.

Liquor zinci chloridi (U. S. P.).

Zinci iodidum (U. S. P.), 1 to 2 grains.

Zinci phosphidum (U. S. P.),  $\frac{1}{16}$  to  $\frac{1}{2}$  grain.

Zinci sulphas (U. S. P.), 1 to 3 grains (emetic, 10 to 60 grains).

Zinci valerianas (U. S. P.),  $\frac{1}{2}$  to 2 grains.

MILD (INSOLUBLE). — Zinci oxidum (U. S. P.), 1 to 5 grains.

Unguentum zinci oxidi (U. S. P.).

Zinci carbonas præcipitatas (U. S. P.), 1 to 2 grains (emetic, 20 grains).

Zincum, U. S. P. (metallic zinc).

**Physiological Action.** — The common action of the soluble salts of zinc is astringent and irritant. These properties are manifested in unequal degrees on account of their different degrees of solubility and their varying affinity for water, and, perhaps, for the tissues.

The chloride and iodide, on account of their high diffusion power and great affinity for water, are the most energetic

of the zinc salts. When placed upon the unbroken skin they are almost inert; when the cuticle is removed, they penetrate the tissues and destroy them for a considerable depth, producing at first a sensation of warmth, which increases to a burning pain, lasting seven or eight hours, by which time the tissues are destroyed, and a white eschar is formed which separates in from seven to twelve days (Ringer). The chloride is a corrosive poison.

The sulphate, having a lower diffusion power, exerts a more superficial action upon the tissues. In small doses it increases for a time the appetite and digestion, but later causes gastro-intestinal catarrh, nausea, and anorexia.

The soluble salts of zinc form insoluble compounds with albumin, condense the tissues, and contract the blood-vessels. They are stimulant and astringent, lessen the secretions, and promote healthy reparative action.

The carbonate and oxide are insoluble, or but slightly soluble, in the animal fluids. They possess no affinity for water, and, though their action upon the tissues is very weak, they are slightly astringent.

The carbonate in large doses produces some nausea and vomiting. The sulphate, in full doses, acts more speedily, is a safe emetic, producing little prostration or nausea, and, as it generally empties the stomach in one complete evacuation, is the best emetic in cases of poisoning (Ringer). No satisfactory explanation has yet been given of the emetic action of the zinc salts. The sulphate excites vomiting when injected into the blood, or when mixed with albumin. Sulphate of zinc in large doses is an irritant poison. The oxide, being insoluble, exerts but little action upon the stomach.

Zinc does not appear to remain in the body, nor to produce chronic poisoning like lead and mercury. The salts are eliminated less rapidly than some other metals, passing out of the system in small quantities by the urine. The chief part may be recovered from the fæces, being probably excreted by the intestinal mucous membrane and with the bile.

**Poisoning by Zinc Salts.**—The chloride is an irritant poison, causing heat and a source of constriction of the throat, a strong metallic taste, a burning pain in the stomach, nausea, vomiting, profound depression of the pulse, coldness of the surface, cold clammy sweats, cramps of the leg-muscles, etc. The mind remains unaffected. In a few instances nervous symptoms have followed, besides the cramps, and in one notable case there was loss of the senses of taste and smell (Bartholow).

Sulphate of zinc in large doses acts as an irritant poison, producing vomiting, colicky pains, diarrhœa, prostration, etc.: symptoms almost identical with those produced by the sulphate of copper.

Zinc-smelters, according to Schlockow, rarely live beyond forty-five, and die, some of bronchial or gastro-intestinal catarrh, others of a peculiar nervous affection which commences with burning superficial pains, exalted sensibility, and reflex activity in the legs, and afterward puts on still more clearly the features of myelitis. A. Sacher finds that the intravenous injection of very large doses of zinc salts produces paralysis of the voluntary muscles.

Epidemic of zinc poisoning among the soldiers stationed at Pahang was caused by drinking water collected from roofs covered with galvanized iron. The water had become contaminated with zinc in such proportion as to cause disease.

The diseases were characterized by the fact that the gastric symptoms predominated over the nervous symptoms. J. D. Gimlette (Brit. Med. Jour., Sept. 7, 1901).

*Treatment of Poisoning by Zinc Salts.*

—Alkalies and their carbonates are the chemical antidotes, producing precipitates. Eggs and milk are useful, forming albuminates of zinc. Further treatment will be indicated by the symptoms as they arrive.

**Therapeutics.** — **GASTRO-INTESTINAL DISORDERS.**—Zinc oxide is an excellent remedy for gastralgia. Bartholow recommends its use for the following condition: Pain after taking food, nausea, intestinal pain, succeeded by prompt alvine discharges, the fæces being made up largely of undigested food. From 5 to 10 grains mixed with aromatic powder and combined with morphine, if need be, may be given before each meal. It is a very efficient remedy in the summer diarrhœa of children:  $\frac{1}{2}$  to 1 grain may be combined with 5 to 10 grains of bismuth subnitrate and 2 to 5 grains of saccharated pepsin, to be given every four to six hours. It is also useful in the chronic diarrhœa of children and adults in doses of from 2 to 10 grains. The sulphate has produced beneficial results in that form of dyspepsia which gives rise to oxaluria, when given in doses of  $\frac{1}{2}$  to 2 grains. In chronic diarrhœa and dysentery it may be combined, as suggested by Bartholow, with opium and ipecac, 1 grain of each in pill being given three or four times a day.

The sulphate is much employed as an emetic in cases of narcotic poisoning, where prompt and efficient action is desired; the dose (6 to 10 grains), well diluted with water, may be given every fifteen minutes until emesis occurs.

**RESPIRATORY DISORDERS.**—The



night-sweats of phthisis are often amenable to a pill containing 3 grains of zinc oxide and  $\frac{1}{2}$  grain of extract of belladonna, given at bed-time. The oxide has been recommended as a serviceable prophylactic against the recurrence of the attacks of spasmodic asthma and as a remedy in pertussis combined with a small dose of belladonna extract.

**NERVOUS DISORDERS.**—In spasmodic and convulsive (clonic) disorders the preparations of zinc are sometimes serviceable. They have been largely used in epilepsy and chorea. Epileptiform vertigo and epileptiform angina pectoris, when they arise from some gastric disorders, are sometimes cured by the oxide of zinc. The valerianate is useful in nervous headaches, nervous cough, hysterical aphonia, ovarian neuralgia, etc.

**CUTANEOUS DISORDERS.**—In lupus, epitheliomata, and unhealthy ulcers the dried sulphate of zinc may be freely dusted over the parts to destroy, by caustic action, the unhealthy tissues. For the destruction of malignant growths the chloride in its various forms—as solution, Canquoin's paste, or Maisonneuve's "caustic arrows"—may be employed. The zinc salts are useful for their astringent action in weeping eczema, impetigo, herpes, intertrigo, seborrhœa, and erythema. The ointment of the oxide is soothing and astringent. The iodide is valued as an alterative in chronic cutaneous disorders and in late syphilitic eruptions.

Carbonate of zinc should be used as a substitute for commercial calamin, since the latter is often impure, and hence objectionable as an application to inflamed surfaces. The following repre-

sents a combination for a cream of carbonate of zinc:—

R Glycerite of starch,  
Lanolin,  
Zinc carbonate,  
Glycerin, of each,  $\frac{1}{2}$  ounce.

The first two are mixed together, then the second two, and last both together. Skinner (*Brit. Jour. of Derm.*, May, 1900).

Peroxide of hydrogen is not durable, and after the oxygen has been liberated nothing remains but water, and water is destructive to the cells. Peroxide of zinc combines all the advantages of peroxide of hydrogen with none of its drawbacks. It has the same properties as zinc oxide, but with an additional molecule of oxygen, which it yields readily, especially in contact with the tissues. The author has applied it to recent and old wounds, burns, and torpid lesions. Gauze medicated with it aids in the healing, at the same time suppressing odor, as he found in 10 cases in which it was used as a dressing after colpotomy. It has always been found an energetic antiseptic, neither irritating nor toxic, keeping well and easily sterilized. Chaput (*Presse Médicale*, vol. i, No. 38, 1904).

**CATARRHAL DISORDERS.**—In catarrhal disorders weak solutions of the soluble zinc salts are useful after the acute symptoms have subsided. Subacute conjunctivitis is relieved by either the acetate or sulphate (1 to 2 grains to the ounce of water). The same solution is valuable as an injection in the subacute stage of gonorrhœa; beginning with the weaker solution, the strength should be gradually increased until the discharge ceases.

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